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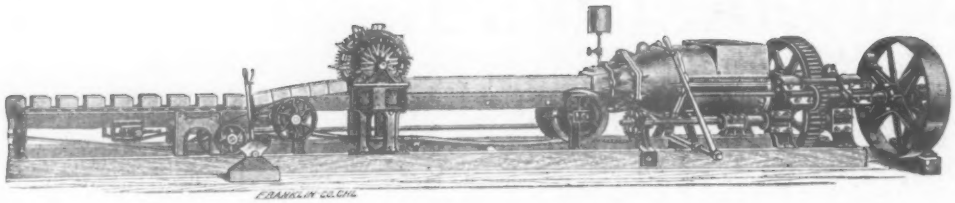

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Paving and Municipal Engineering

VOLUME IX. AUGUST, EIGHTEEN NINETY-FIVE. NUMBER 2.

STREET CLEANING AS A SANITARY ENGINEERING PROBLEM.

By William Paul Gerhard, C. E.

THE maintenance of city streets and the scientific administration of street cleaning in large cities, require a great deal of engineering knowledge, practical skill and judgment, besides not a little executive ability. It is not often, however, that the matter is considered in this way. Many instances could be quoted where in municipal departments mere politicians are placed in charge of the street-cleaning bureau, no doubt because street cleaning, like the construction of a state capitol, often involves the employment of a large force of laborers whose political vote may thus be controlled at election time. Street cleaning may legitimately be considered one of the important problems of sanitary municipal engineering. Viewed in this light, the recent appointment, by a reform mayor, of an able civil and sanitary engineer of high reputation, to the position of street-cleaning commissioner in the city of New York, can not be too highly commended.

The quantity and the composition of street dirt depend upon a great many points, such as the character and material of the pavement, the width of the street, the density and class of population, the nature and size of the traffic, the condition of the weather, etc. Road detritus is composed chiefly of abraded particles of stone, wood, iron and shoe leather; gravel, sand or mud from the subsurface; the horse-dung and urine of animals, mixed together with house refuse, ashes, street and yard sweepings, more or less garbage, dead leaves and other vegetable matters.

Regarding the comparative quantity of street dirt fron different

pavements, an English engineer is authority for the statement that one cartload of street mud is, on the average, removed from 344 square yards of macadam, from 500 square yards of granite, from 1,666 square yards of wood and from 4,000 square yards of asphalt pavement.

It is well known that streets in a bad condition are an obstruction to traffic, and that they necessitate a waste of energy and tractive force. We are accustomed to consider muddy streets as an annoyance, and we condemn unclean streets principally on account of untidiness of appearance. Very few people, however, take into consideration that, owing to air and soil pollution, caused by accumulation of dirt and refuse matter and soakage of liquid impurities, there is a powerful influence on public health, which by far outweighs all other disadvantage. It is a fact that clean and well-kept streets cause a marked reduction in the death rate of large cities, particularly as regards malarial and pulmonary ailments. Children playing in unclean streets are more or less affected, being often much more susceptible than adults; the same is true of invalids, and people not in robust health. Sanitary science, therefore, requires that the street surfaces be impermeable and that all thoroughfares should be kept scrupulously clean. Near children's schools, near institutions, and near hospitals the streets should, for obvious reasons, be swept with particular care, and be arranged with a view to perfect drainage. In all advanced schemes for the ventilation of buildings the fact that street dirt is injurious to health is taken into consideration, by providing special means for screening and filtering the air supply from outdoors, or by washing out its impurities. Dirty and dusty streets exercise at all times indirectly a baneful influence upon the salubrity of habitations, because they prevent the free ventilation of living or sleeping apartments by the opening of windows.

We have yet much to learn from Continental cities, which are far ahead of ours in the matter of street cleaning. This fact is generally conceded by all Americans who have traveled with open eyes through Europe, and who have admired the tidy and well-kept streets of some of its capitals. It is a matter beyond comprehension to me how the mayor of a large American city, after returning from a trip to England and the Continent, could have stated, as the

newspapers reported, that, in the matter of street cleaning, American cities had nothing to learn from cities like Paris, London, Berlin or Vienna.

The work of street cleaning presents difficulties which are not easily surmounted, chiefly on account of the enormous quantities of street refuse to be removed daily. It is accomplished by scraping, sweeping, washing and flushing. The sweeping may be done by hand labor with brooms, or else by the use of special machinery. Owing to the greater rapidity with which the work is done there is economy in using the best machinery, implements and tools available. Mechanical sweepers should displace hand labor, for street cleaning by hand is from three to six times as expensive as cleaning by the aid of machines. It is a curious fact that the first street-cleaning machine, devised by Sir Joseph Whitworth, was rejected "as interfering with the labor for poor people." Street sweeping should always be done without stirring up dust and dirt. Hence, water is needed in street-cleaning operations, and all streets should be sprinkled before sweeping.

Carelessness in street sweeping should not be tolerated. In all large cities, street cleaning should be preferably done at night-time. The method of cleaning streets by washing the filth and dirt into the gutters and catch-basins, and thence into the street sewers, can not be approved, except in special instances, as it simply transfers the dirt from the street surface to the catch-basin and the sewer. Dry removal of street dirt in large, well-built, covered carts is much to be preferred. Horse-droppings on important thoroughfares should always be picked up at once and removed with brushes into handbags. The fact should be noted that the extensive application of steam and electricity to replace horse traction in surface roads tends to reduce the amount of organic street dirt. The ultimate disposal of the collected street refuse is another problem which may present difficulties in large cities with many miles of pavements.

LIFE OF ASPHALT PAVEMENTS.

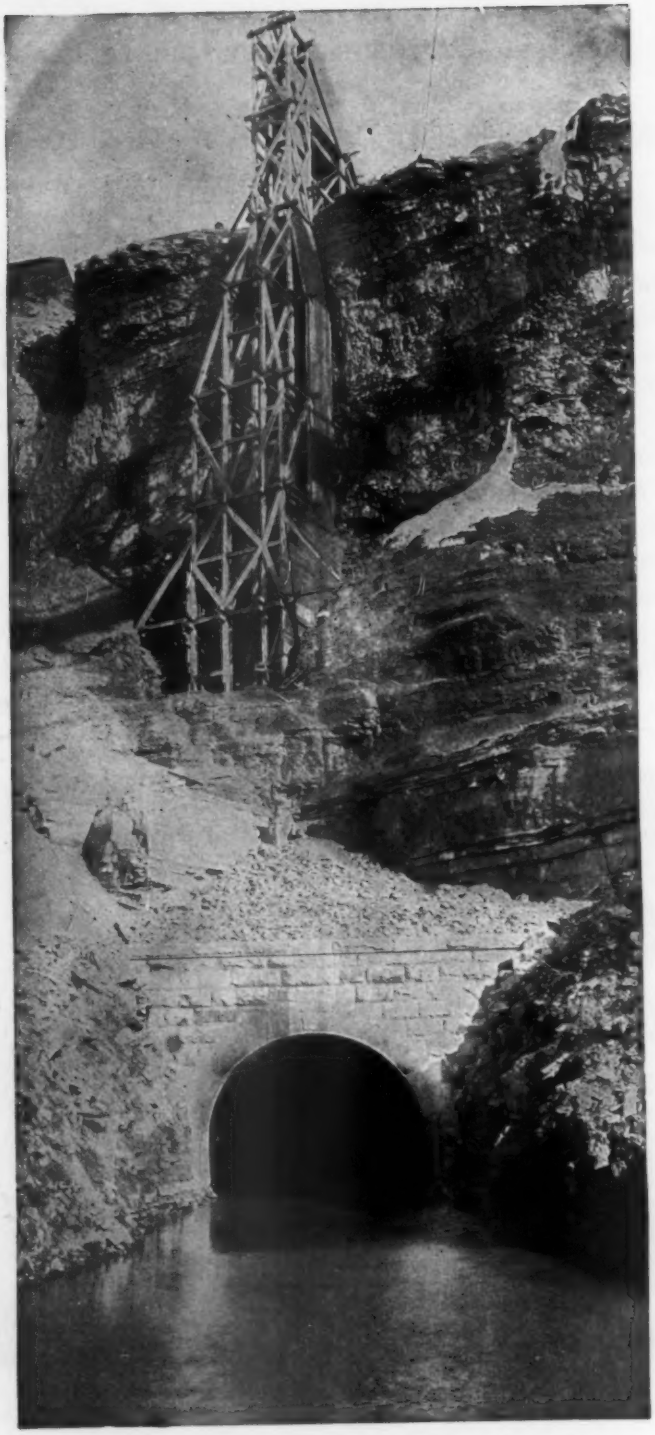
By Clifford Richardson.

THE life of an asphalt pavement depends upon three things:

The materials of which it is constructed; the skill with which it is laid; the amount of traffic it sustains.

With the best materials, combined and laid with the greatest skill, where traffic is of ordinary character and the street not too narrow, so as to confine wheels to ruts, the life of the pavement should be fifteen years. There are surfaces in existence to-day, which are of that age, which have had scarcely any repairs and seem to be good for many years to come. Such a pavement can be seen in front of the Arlington Hotel on Vermont avenue, in Washington, District of Columbia. Where, through lack of judgment, too much or too soft cement has been used, the surface is soon liable to push out of shape. Where too little or too hard cement has been employed, the surface cracks after a few years, and scales and disintegrates in the colder months of the year, and other mistakes make themselves known in similar ways.

The best pavements, in addition, have enemies which will destroy them if not prevented. Water penetrating into the base and surface from the seepage of ground higher than the pavement has injurious effect, while the escape of illuminating gas from the mains produces a peculiar and characteristic disintegration which is readily recognized. The success with which asphalt surfaces have been maintained on some of the narrow streets of the lower part of the city of New York, with the very heavy traffic there met with, shows that with skill in laying they may be made suitable for even very trying conditions; and as they have been maintained at such geographical extremes as New England and Louisiana, it would seem that climatic conditions do not qualify their use.



OUTLET OF NIAGARA TUNNEL BELOW NIAGARA FALLS.

RELATION OF THE BICYCLE TO THE GOOD ROADS MOVEMENT.

By S. H. Finley, City Engineer of Santa Ana, Cal.

INVENTORS are now turning their attention to the production of a motive power for individual conveyances which will relegate the horse to the rear. He is entirely too slow for this age; but before he can be supplanted and any power enter into successful competition with him on the open roadway, there must be a great improvement in their construction. A good road surface is an essential feature that must precede the successful road motor, which must embrace great power, simplicity of operation and construction. These requirements are being rapidly met. Strange to say the combination of various principles of philosophy, some of which have been known for ages and others which are yet unsolved completely, has resulted in producing a vehicle, in the bicycle, manipulated by human power, which demands the same highways, only improved,

EAST RIVER (NEW YORK) GAS TUNNEL.

that man traversed in the first period of his existence. Profiting by nature's teaching in the silent and clinging tread of the hoofless animal, and adopting the pneumatic tire, and conquering in a great measure the worst enemy of perpetual motion cranks—friction—by adopting the rolling sphere, the inventor has adopted the known principles of suspended rim, tangent spoke and lever, and produced a conveyance, the bicycle, which, for weight and strength has no equal and which marks the present climax of mechanical skill. This vehicle, propelled as it is by a human muscular force, has opened man's eyes to the fact that a firm, smooth footing for any vehicle is a great saving in time and energy, and convinced him of what the beasts of burden have known, but could not intelligently express, since they first traversed Eden's

CABLE CONSTRUCTION, METROPOLITAN STREET RAILROAD, NEW YORK.

pathways. Hence it is that this machine, once a toy, then a luxury, but now a necessity in the active business life of hustling humanity, has resulted in creating a demand for better roads, which, when obtained, will be hailed with delight by every horse, and recognized as an economical investment by all persons having occasion to traverse them. Already man propelling the bicycle far outstrips the horse in speed even on our poor roads. Having noticed the great difference in muscular energy required in propelling it over good roads and poor roads he has become convinced of their economy. Hence the present agitation for improved footing.

As the desire for some motive power other than animal increases, the sentiment in favor of better highways will increase.

The last half century has been one of such marvelous developments in controlling the powers of nature that the human race has almost lost sight of the first principles of construction and maintenance of the people's great arteries of trade, which convey the life-blood through communities and nations—from village to town, from town to city and from nation to nation.

We have been accustomed to point to the steam railroad as the cause that has revolutionized the world, and well we might. A few years hence, if I mistake not the signs of the times, we can refer to the good-road movement as a greater civilizer. We have been railroad wild in the past and devoted all our energies to that method of travel. Railroad building has reached the climax and in the future it will only keep pace with the development of the country.

The crying need of the day is a successful power-driven road vehicle. It is all but being born. The inventor is only waiting for a demand and a track on which to operate it. Let the people perform their part and the inventor will do the rest. A good road surface is necessary. The French farmer has provided that to a degree far beyond any other nation, and the inventor is making that his field of experiment. Already competitive trials of various road motors have been made there and it is in the range of probability that a successful one may soon be produced. The success of the bicycle has solved one of the difficulties by proving that great strength can be obtained in a light machine. Others are being overcome and a light but powerful motor is the thing of

the near future. Let us prepare for its reception as well as a more economical use of our present vehicles by placing our roads in proper condition.

The first step is to educate the people to believe in good road construction as a business proposition. With our present roads and past and present methods of construction and maintenance as a text this is a difficult task. We have been accustomed to throw up a ridge of sand and dirt with a grader and call it a good road. When we undertake to argue a man into voting for an expenditure of $1,000 or $2,000 per mile for a good road he naturally (having the sand road in his mind) maintains that the benefits will not justify the cost. The experience of all communities where road improvement has reached its most advanced stage has been that the opposition came from those most benefited, namely, the farmer. It is not because he is opposed to advancement or does not believe the roads can be improved to advantage. It is from fear of taxation. He has come to think that what money he pays into the hands of the tax collector has gone from him forever never to return in any way. Year after year the average farmer pays from $5 to $25 to maintain his roads and he never sees the result of its expenditure, because it takes all of it to keep a poor road from getting into a worse condition. If the money he pays were economically and judiciously, and I might say lavishly spent, so as to make permanent the improvements that are undertaken, his opposition would soon disappear and he would become the most earnest advocate of an increased expenditure. Convince him once that he is going to get value received for his money and he will smilingly walk up and meet the demands of the tax collector instead of reluctantly, as he does now.

The first lesson in this education will doubtless have to be forcibly imparted against great opposition, but the second will be gladly taken. The tax-payer will find that the heavier his tax the easier it is to pay. With improved roads he will find that new sources of revenue will be opened up to more than compensate for the increase.

The next step is to disabuse the people's minds of the prevailing idea that every man is a natural-born road-builder—that any one can construct a road.

Road construction is a work by itself. Men must be trained in

it. They must be able to judge of materials and handle men to advantage. A farmer, simply because he can drive a horse and handle a plow, is not necessarily a road-builder any more than a hardware man is a good cook because he handles utensils used in that work. A blacksmith or machinist is not a road-builder because he makes tools used in their construction. The geologist is not a road-builder because he can tell the qualities of the various rocks and materials. The civil engineer is not necessarily a road engineer because his services are required in locating them; but many accomplishments possessed by those various classes of men are essential to a successful road engineer.

France, in obtaining her highway system, paid as much attention to the work as a railroad company does to the building of its road.

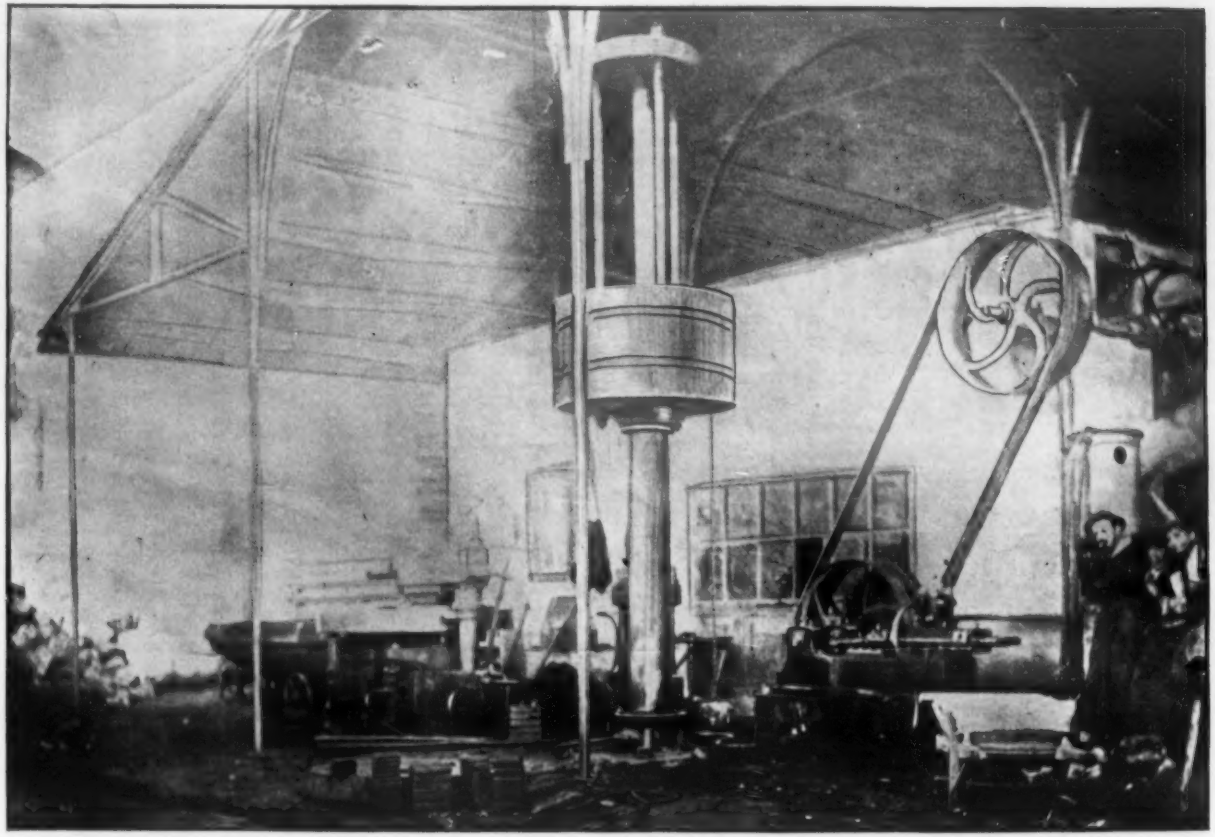
There are many things to be taken into consideration in constructing an economical road. If there are two points which it is desired to connect, a thorough examination should be made of the territory between those points over which the road might pass. If there are intermediate places of note, they should be considered in its location. A road on a direct line is of course preferable, but if it is secured at the expense of excessive grades, it is inadvisable. There is a point between distance and grade which the experienced road-builder will readily select. He should take into consideration the maintenance, and consider that while a road built over a hill is much cheaper to construct and more economical to traverse with loads, it is nevertheless much more expensive to maintain. There is a middle found between cost of construction and cost of maintenance that should be chosen.

NATURAL ROCK ASPHALT PAVING IN EUROPE.

By W. H. Delano, Manager Compagnie Générale des Asphaltes de France.

In Paris the municipal council at the suggestion of their engineers has had paved with Seyssel rock, laid by their contractors, the Compagnie Générale des Asphalte de France, a considerable surface of narrow streets, blind alleys and courts in the center of the city.

It has been found that compressed asphalt is not only the most



MACHINERY FOR MAKING COMPRESSED ASPHALT SLABS.

hygienic but also the cheapest mode of pavement, and now that transit to the suburb is so cheap, the working classes who pay the greater portion of the 170,000,000 francs tax ($34,000,000) will no longer live in dear and unhealthy slums.

Some 20,000,000 francs, or $4,000,000, is to be laid out in drainage works so as to further reduce the death rate within the city limits and prepare Paris for the grand exhibition of 1900 of which the building alone will cost 100,000,000 francs, or $4,000,000.

A large surface of old compressed asphalt on 4-inch hydraulic lime concrete, the maintenance of which the Compagnie Générale would not take over, have been relaid this year by the town of Paris at its own expense and more new work laid. Wood is still being laid, but a reaction has set in against it headed by the doctors—it has been proved to breed the microbes of diphtheria and tetanus. The putrid fibrous dust from an old wood pavement is most deleterious to the eyes and throat.

Last year the first section of an underground railway was laid about two and one-half miles long, down the boulevard St. Michel, from the Place Deufert-Rochereau to the Hotel Cluny, and which will be continued to the Place des Invalides and the Champ de Mars, for the 1900 International Exhibition.

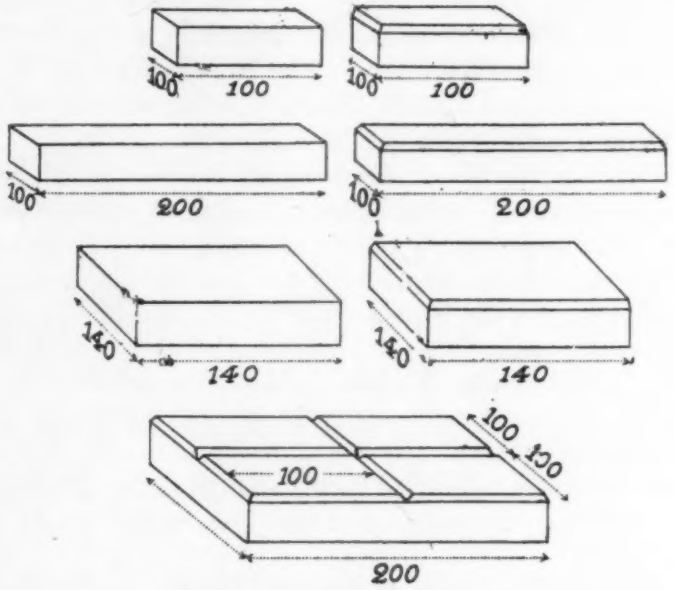
This gave rise to an interesting piece of asphalt work. The vaults of a surface above 250,000 square feet were covered with a coating of Seyssel mastic 9-16 of an inch thick, and the floor underneath the ballast and rails was made of bituminous concrete, composed of Seyssel mastic, refined Trinidad pitch, sand and pebbles; about 1,000 cubic yards were laid in varying thickness, chiefly in front of the astronomical observatory, to avoid vibration to the mercury bath on which the reflected progression of the heavenly bodies is observed during the day; also to the delicate instruments, and to the adjacent dwelling-houses. This is perhaps the most important application of this valuable material yet carried out.

Over two-thirds of the compressed asphalt in Paris is maintained by the Compagnie Générale, who formerly laid the whole as the originators of the industry.

The Compagnie Générale has also laid about 60,000,000 square

feet of Seyssel mastic sidewalks in Paris alone, refined Trinidad pitch being used as a flux for the Seyssel rock after pulverization.

Since a short time compressed asphalt slabs, made under Mr. Malo's patent of 1873, have been in demand from architects in Paris on account of their pleasing color, which harmonizes so well with building stone. They are laid on concrete in a Portland cement mortar, like glazed tiles.



COMPRESSED ASPHALT SLABS.

The hydraulic press in which they are made is fitted with an accumulator, as shown by the accompanying illustration; there are two pistons, giving two successive pressures, on a revolved platform; the unmolding is effected simultaneously; the powder is heated on a kiln alongside the press. The powder is heated just as if for a street pavement.

Several eminent engineers from the States have visited the Seyssel works and mines during the last two years. The Seyssel mines are within a drive from Aix-les-bains, Savoy.

Berlin ranks as the first city in Europe for natural compressed asphalts. It contains now over 1,200,000 square yards, or nearly as much as London and Paris combined; the mixture of Vorwohle with the higher grade of asphalt rocks, Seyssel, Val-de-Travers,

Mons and Sicilian, has caused a good many repairs during the last severe winter—the severest since 1879. Vorwohle and Limmer asphalt rocks are rather impregnated with bituminous oils than pure bitumen solid, at 60° Fahrenheit. This is proved by the simple fact that they will not compress, and can only be used for mastic, but then good, sound refined Trinidad pitch should be used as a flux, whereas more often paraffin still bottoms, from Halle, in Prussian Saxony, are used, known in the trade as "Hallenser Dreck." A lot of such cheap mastic, containing a large proportion of fine sand, is sent to the States. The 20 per cent. duty is trifling in amount. It is used also in Germany on account of its cheapness, but mixed with Seyssel or Val-de-Travers mastic.

The bitumen in the Val-de-Travers rock is also of an oily nature, whilst that of Seyssel, Sicilian, Mons, is firm at an ordinary temperature. This is proved by the Vicat needle test. Large surfaces of compressed asphalt, supplied by the Compagnie Générale were laid at Hamburg, for the Kaiser's visit on the occasion of the opening of the Kiel Canal.

In Cologne, Hanover, Dresden, Leipsic, Frankfort-on-the-Main and Strassburg (erstwhile French), large and increasing surfaces of asphalt are being laid.

German chemists have tried their hands at imitating the natural rock, but with no success—one might just as well try to imitate coal.

The town of Munich has declared for wood.

In London, the asphalt business is thriving—none of the companies using Seyssel, Sicilian, Val-de-Travers or Mons rock giving less than 7 per cent. dividends.

In Philadelphia Mr. W. S. P. Shields has laid some 36,000 square yards of natural rock. During a visit to Paris and London last February to see the works and mines of the Compagnie Générale, he ordered a cargo of rock and another is being forwarded since for work in Brooklyn.

Mr. Boorman, the manager of the American branch of the Compagnie Générale in New York, has obtained a street to lay in the center of the city of New York under the new specifications prepared by Mr. E. P. North, C. E., who has now entire charge of laying pavements in New York. This gentleman has visited the as-

phalt mines and works in Europe on several occasions. I remember seeing him in Paris on a mission from the city government fifteen years ago, and he read a paper on the subject of rock asphalt roads before the American Society of Civil Engineers in 1879, which is not at all out of date—*au contraire*.

During a recent visit to Chicago, Milwaukee, Pittsburg and Philadelphia I have been told that natural rock asphalt is more slippery than the Trinidad pitch compound. This is a counter-verity. The fact is that neither is slippery *per se*, but that if drizzling rain fall on either and convert the fine dust thereon into liquid mud then that mud is slippery on both equally.

WM. HENRY DELANO, C. E., was born in London, of an old Jamaica (W. I.) family. He was a pupil of J. L. Mamby, in Paris, and subsequently of Chas. Mamby, Honorable Secretary of the Institute of Civil Engineers, London. After spending several years in mechanical engineering in Italy, Spain, Portugal, Germany and Egypt, he was induced in 1871 to devote his entire attention to the asphalt industry in France, where he had been chiefly educated. In 1863 he was elected a corporate member of the Institute of Civil Engineers in London; in 1871 a member of the Institute of Civil Engineers in Paris. For the past quarter of a century Mr. Delano, guided by his Gamaliel, M. Malo, has been one, if not the chief, exponent of the rock asphalt industry in Europe. The company of which Mr. Delano is the managing director, has done more extensive and profitable work than any other in Europe. This summer was the occasion of the fifth visit of Mr. Delano to the United States where he is now almost as well known as abroad.

A RECENT VISIT TO PITCH LAKE OF TRINIDAD.

*By Prof. S. F. Peckham.**

My first impression as I looked over the expanse of the lake was a surprise. I had expected a scene of desolation. Nothing could be further from the reality. In the center were the islet so often described. Within and around them a dark area resembled the muddy bottom of a pond from which the water had been drawn off, with here and there patches and intervening streams of water remaining. From the border of this dark center, the vegetation arose higher and higher around almost the entire circumference of the lake, until it reached a border of palm trees from thirty to fifty feet high. As I looked over the lake I beheld on a vast scale the

* Extract. *American Journal of Science.* Vol. L. July.

appearance of asphalt beds that I had many times seen in California.

An examination of the borders of the lake showed that it occupied a bowl-like depression in a truncated cone that rested against the side of a hill that rises above the lake to the southwest. Along the line of ascent that I had followed, the slope towards the northeast to the sea is very gradual. In other directions the ascent is abrupt, sometimes steep, especially toward the south. These slopes are covered with tropical jungles consisting of palms of various species, sedges, canna and wild vines. The border of this depression presents upon the inside for the most part an escarpment of sand and clay, that has evidently been built up and afterwards broken down in many places by water. Wherever excavations have been made in the cone or the escarpment they show that the cone consists of both asphalt and earth. At a point on the south side, near where the road leaves the lake, the appearance of the surface indicates that the drainage of water from the lake was frequently in that direction to a considerable amount, notwithstanding numerous artificial drains lead out of the circumference of the lake and the wide natural outlet down the slope to the sea. To the northwest towards the sea, a heavy stream of asphalt has overflowed to the sea, forming a barrier reef for a considerable distance. Asphalt has also overflowed to the south, and the general appearance of the escarpment seemed to indicate that at some remote period the basin now occupied by the lake had been filled some three feet higher than the present level of the lake. I looked in vain for any evidence that the mass within the lake had been recently depleted; but I am aware that observations at considerable intervals of time would be necessary to establish that fact, by referring the mean level of the lake to some fixed point by means of a very careful trigonometrical survey.

A very careful study of the present appearance of the lake and its boundaries led me to believe that the suggestion of Mr. Richardson, that the lake occupies the crater of an old mud volcano, is correct, and that it has been built up of very unstable material, through contact of water issuing in large quantity from subterranean springs which has come in contact with strata identical with or

resembling those described by Mr. Guppy.* Into this ascending current, resembling a quicksand, was projected bitumen, at intervals in very large amounts, so that irruptions of mud have coincided with and alternated with irruptions of bitumen, the whole building up the cone and at times overflowing it, while the basin has gradually filled with bitumen to the exclusion of mud.

It is, however, equally evident that for an indefinite period there has been an outflow of bitumen from the crater towards the sea, at La Brea, not over its rim, but through a crevice in its side; in fact through its broken-down side, and that, notwithstanding the vast quantities of asphalt now being taken from the lake by the concessionaries, the movement is still out of the lake.

Captain Alexander, in 1832, spoke of the flow out of the lake as "immense." Manross, in 1855, says, "this stream of pitch has been dug through in several places, averaging from 15 to 18 feet in depth." A well dug at one point on the slope of the overflow was abandoned, still in asphalt, at the depth of forty feet. Several village lots have been excavated to a depth of twenty feet, still in asphalt. The invariable reply of the negroes to the question, "Have you ever dug through the asphalt?" was, "No, sir." The conclusion that I reached on the ground is, that the asphalt flowing down the slope to the sea fills a ravine excavated by water, and that it is slowly moving out of the lake with the pressure of the asphalt in the lake behind it. This conclusion is in harmony with the testimony of all of the observers above quoted for the last hundred years.

Concerning the condition of, and appearance of, the pitch within the lake, I think it is quite certain from all the observations quoted that the pitch has gradually become harder and more stable during the last 106 years. I do not think that later observers have any right to question the veracity of those who have pre-

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*Guppy says (*Quarterly Journal Geological Society*, xlviii, 527, note): "When a piece of the foraminiferal rock is placed in water, it absorbs it rapidly and falls asunder, and the water which enters into union with it is given up only to evaporation * * From these properties it follows that the natural soil roads passing over these rocks become in the wet season the worst quagmires it is possible to imagine." Of another bed: "In the presence of water this rock is the most incoherent of any I have ever met with. * * It falls into powder at the mere contact of water."

ceded them. Dr. Nugent says, that in 1807, the center was so soft that it could be dipped up with a cup. Alexander describes it in 1832 as so unstable that the weight of a man produced a bowl-like depression to the depth of one's shoulders and that the heat gradually increases as one walks off towards the middle with his shoes off. Manross, twenty-three years later, says, "It may be that the material has become much harder since the first accounts of it were written; but it is difficult to understand how the weight of a man can have displaced a mass of pitch equal to a 'great bowl' as deep as the shoulders." Kingsley, twenty-four years later, is practically of the same opinion. At the time of my visit, a man was loading a cart near the center of the lake, and while they did not remain in one place long enough to secure a large load, there was no apparent danger of their being engulfed.

Yet it must not be assumed that the cosmical agencies that produced this deposit of bitumen have ceased to be active, or are even simply quiescent. Abundant evidence is to be found in the neighborhood, and even within the lake itself, that such forces are still active. A few miles to the southwest of the lake, at Guapo, large springs of maltha, or "liquid asphaltum," are now flowing, and within the boundaries of the lake, near the power station of the tramway, and within only a few rods of the edge of the cone, I observed what the workmen called (and very properly) a "blowhole." This was a circular hole, about six inches in diameter, from which bitumen, more nearly fluid than any I saw elsewhere upon the island, had been ejected to the amount of perhaps a barrel. It was so soft as to flow readily, of a brilliant black color, and appeared to contain little, if any, mineral matter. I was told by a workman that such holes occurred quite frequently, and so far apart as apparently to have no connection with each other.

Asphalt beds occur in California that are the product of the hardening of maltha, or mineral tar, which escapes over a considerable area. Sometimes it flows continuously from a central orifice, but oftener the flow through the hot summer seems to be arrested by the lower, winter temperature, when the orifice through which the flow took place becomes plugged. The succeeding season the maltha issues along a line of less resistance and flows through the summer, when it in turn becomes plugged. These

plugged orifices are often several rods apart in successive seasons, and present the appearance of a cicatrix. I have no doubt that more extended observations than I was able to give would reveal a similar condition of outflow at and in the vicinity of the lake.

I carefully studied these phenomena as likely to offer some suggestion concerning the origin of the deposit. As a description of the observed facts, I can add nothing to that of Mr. Manross. I do not understand why Messrs. Wall and Sawkins observed nothing of the sort described by him, or thought it not "very obvious to what force or what influence this is attributable." These "areola" are very irregular in shape. I think their form may be, to some extent, determined by the weight of water pressing against their sides. The surface of each one is slightly rounded from the center to the edge of the water; they then round off at a very sharp angle, finally descending almost perpendicularly. These areas consist of pitch inflated with gas to such an extent that, when broken into, the structure exactly resembles an over-fermented cheese—hence the term "cheese-pitch." The cavities are from one to three or more inches in dimensions. The gas that they contain is constantly rising to the surface, where it bubbles out and bursts, thus forcing the center up, and causing a slow but irresistible movement from the center towards the circumference, where the pitch continually rolls under, exactly as Manross has described it. His suggestionc soncerning the ebullition of the mass within the lake were confirmed to the very letter.

This action is explainable in this wise: Mr. Richardson's analysis of asphalt water shows it to be very rich in sulphates. As has been elsewhere shown, sulphates, especially those of the alkalies, when in solution are decomposed, when the water containing them flows through strata impregnated with organic matter, into hydrogen sulphide and a carbonate of the oxide presents. When hydrogen sulphide infiltrates strata containing carbonate of lime, gypsum is formed and sulphur deposited, or converted into free sulphuric acid.*

The Miocene bituminous strata of Southern California are full

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* Proc. Am. Philos. Soc., x, 445. Bischoff, Chem. and Phys. Geol. (Cav. Soc. Ed.) II. 28; *Ibid.*, i, 15, 340. T. S. Hunt. Chem. and Geol. Essays, pp. 23, 87, 99, 111.

of sulphur springs and numberless deposits of sulphur. One such deposit in the southern part of Kern county is supposed to contain several thousand tons of sulphur.

The reaction between sulphates present in the lake water and the bitumen or other organic material of the formation, furnishes a ready explanation of the presence of hydrogen sulphide; but I must confess that the odor of that gas was much less apparent about the lake than I had been led to expect. Analysis will alone show what the gases are that inflate the asphalt, but of their presence in enormous volume there can be no question. At a rough estimate, I should say that from one-third to one-half the volume of the mass, as it exists in the center of the lake, is gas. I also hazard the opinion that this gas makes the *mass* specifically lighter than water, else the tables described by Manross and Kingsley would not rise and spread on the surface of the water, and further, the masses of asphalt would coalesce, and the water would float upon the asphalt. Moreover, it is without any doubt, that through this motion or ebullition which is produced, not by escape of vapor generated by heat, but by gases forced upward by their own specific gravity through a yielding mass, that the asphalt and mineral matter which forms the floors and sides of the crater, are mixed together until the asphalt is saturated, *i. e.*, it reaches such a condition of plasticity and viscosity, that it will no longer absorb any more mineral matter in presence of water. I can not account for the almost uniform character of the mixture of water, bitumen and mineral matter, on any other hypothesis.*

Asphalt is very inert to changes of temperature. It is a very poor conductor of heat, and even under a tropical sun the daily surface changes of temperature and consequent expansions and contractions are wholly inadequate to produce conditions affecting such enormous masses of material as the crater contains.

The frequent use of the term "volcanic" in connection with the supposed origin of this mass of bitumen is in my judgment

* Mr. Richardson asserts that 90 per cent. of the 80 per cent. of insoluble mineral matter in the pitch is silica. As a possible explanation of the presence of so much silica, I would suggest that the hot water that distilled the bitumen, might have held silica in *solution*, which has been precipitated within the pitch as it has cooled. The fact, if it be a fact, that so much silica exists in the pitch as hydrate, may account for the large amount of water held in the pitch.

misleading. With the term volcanic is usually associated streams of melted lava, scoria and pumice. The masses of porcellanite and jasper mentioned by all observers as found in the neighborhood of the lake, do not require for their origin any "subterranean fires." It only requires that hot water, holding silica in solution under high pressure, shall percolate a bed of clay. The distillation of beds of lignite requires nothing more. In one case the product is red or yellow jasper, in the other a deposit of bitumen. The less the pressure, the more dense will be the bitumen. Water will inevitably bring the bitumen to the surface, unless it is held down by impervious strata. If the water accompanied by bitumen encountered in its upward passage such strata as has been described by Mr. Guppy, a mud volcano yielding bitumen would be the inevitable result. It appears to me that all of these conditions are present in and about the pitch lake. They are exactly the conditions that have produced enormous tar springs and asphalt beds in California, excepting that there the strata necessary to produce mud volcanoes are wanting, but the porcellanites, the hot springs, the sulphur springs and the bitumen are all there, and in some localities on a scale that vies with Trinidad.

I looked in vain for specimens of wood in process of transformation into asphalt. I inquired of many intelligent men, and others connected with mining the pitch, if they had ever seen such specimens; they invariably answered "no." Two or three remarked that the wood never decayed in the pitch, that it came out as it went in. One man replied that, "if it went in rotten it came out rotten." I saw in several excavations along the tramway masses of vegetable matter that appeared to have been converted into humus, and was told by the workmen that in time these masses would become incorporated with the pitch. Such masses account for the organic matter in solution in the lake water, and also for the amorphous organic matter not bitumen, observed by Mr. Richardson.

The concessionaires of the lake have recently put in operation a tramway and pier by which the pitch can be very rapidly and easily removed from the lake to vessels lying at the pier. The tramway forms a loop, which in a general way may be said to pass just outside the circle of islets. In building the tramway much of

the vegetation on these islets has been destroyed. The laying of the tramway presented some peculiar engineering difficulties that have been successfully overcome. The islands float on the pitch, and I believe that they represent portions of the edge of the crater, broken off during violent irruptions, and placed in and maintained in their relative positions through their relations to the various centers of ebullition into which the surface of the lake is divided. These islets, which largely consist of vegetatable matter, float, while logs of wood and palm-tree ties sink in the pitch. It therefore occurred to Mr. Freeman, the engineer in charge of the work, to support his tramway on palm leaves, of which many specimens are twenty-five feet in length. This expedient has proved a complete success, not only upon the summits of the "areola," but in crossing the crevices that separate them. The tramway furnishes a succession of admirable points from which to view the lake, as no difficulty is experienced in walking upon the ties around the entire loop. The cars are run in groups of four, which, when loaded, have a gross weight of about six thousand pounds. I carefully watched the passage of successive groups of these cars and could not observe any change of level in the road-bed, as they passed along; yet I am quite certain if a group had been allowed to stand for several hours, that both tramway and cars would have sunk in the pitch.

The pitch is excavated along this tramway upon the summits of the "areola." Wherever the surface of the pitch is broken, the vesicles are uniformly smaller as the pitch is taken from points removed from the center of the lake. As the water dries out, the vesicles collapse and the color changes from brown to bluish black. If left long enough in the sun, any of the pitch, no matter from what spot it may be taken, will first melt upon the surface and finally flow into a more or less compact mass. The pitch being dug by the Trinidad Asphalt Company, both within and without the lake, was brown when freshly dug, changing to black on exposure. The same might be said of that dug farther down the slope from village lots by the Trinidad Bituminous Asphalt Company. It was quite evident that as the pitch was taken from points farther and farther from the center of the lake it had been subjected to more and more pressure, the gas being forced out as a consequence,

the vesicles made smaller and the specific gravity thereby increased.

PROF. S. F. PECKHAM.

There are enormous masses of pitch within the lake that could not in my opinion be distinguished by the eye from the pitch taken from village lots by either of the companies before mentioned. I am therefore quite at a loss to determine why Mr. Richardson alleges such a specific distinction between what he is pleased to term "lake" and "land" asphalt. It appears to me to be a distinction without a difference.

BRICK PAVING SPECIFICATIONS IN LEADING CITIES.

UNTIL standard specifications for brick paving are adopted by some organization which engineers are willing to recognize as an authority there will continue to be variation in the requirements of contractors and a corresponding difference in the quality of work. Methods of work are more likely to become uniform, however, than the manufacture of material. The first important step, therefore, is to establish standard specifications for brick, and uniformity in laying the brick will, as with asphalt and other materials, easily follow. The committee appointed at the last meeting of the National Brick Manufacturers' Association, to prepare standard specifications for paving brick will, it is expected, solve the problem for manufacturers. We are advised by the chairman, however, that the committee has not yet begun its work and has held no meeting, though it will doubtless soon take the necessary steps to have a report ready for the annual meeting to be held next winter.

The methods of laying brick pavements believed in some of the leading cities to be the best may be compared from the abstracts* of specifications given below:

* "Brick Pavements," Clay Publishing Co., Willoughby, O.

CHICAGO.

Grading.—The street is to be graded to conform to stakes and profiles furnished by the engineer in charge, thoroughly compacted and rolled with a ten-ton steam roller; or, where this is not practicable, by a five-ton horse roller.

Foundation.—Two styles of foundation are used, namely, concrete and macadam. The concrete shall be composed of one part of finely-ground hydraulic cement, two parts of sand, and five parts of hard limestone, broken so as not to exceed 2½ inches in their largest diameter. The cement and sand to be mixed dry, then made into mortar, and the broken stone, thoroughly wet but containing no excess of water in the heap, to be incorporated with it. After being properly formed in the roadway, the concrete must lie exposed for at least eight days before the brick are placed upon it.

Macadam, if used for foundation, shall be composed of clean stone, broken so as to pass through a ring from two to three inches in diameter. Upon the stone shall be spread sufficient limestone screenings to fill all interstices; then flooded and rolled with a ten-ton roller.

Cushion.—Upon the foundation shall be spread a layer of clean, coarse, sharp lake sand.

Laying the Bricks.—The bricks should be laid on edge close together at right-angles to the curb, breaking joints. On intersections and junctions of lateral streets, the brick shall be laid at an angle of 45 degrees with the line of the street. The brick when set shall be rolled with a 5-ton roller, or rammed with a 30-pound paving rammer.

Filler.—The joints between the brick shall be completely filled with asphaltic pitch, heated and poured at a temperature of about 300 degrees Fahrenheit.

Top Dressing.—The surface of the pavement shall then receive a one-half inch dressing of clean, coarse lake sand, spread evenly over the whole surface.

PHILADELPHIA.

Grading.—The street shall be graded to a sub-grade of 9½ inches, and thoroughly compacted by rolling with a 5-ton steam roller. Soft and spongy places shall be dug out and refilled with

coarse sand or gravel screenings, and rammed solid previous to rolling.

Foundation.—Upon the sub-grade shall be laid a bed of hydraulic cement concrete, 4 inches in thickness. The concrete shall be composed of one measure of cement and two of clean, sharp sand, mixed dry and made into mortar with the least possible amount of water. The stone shall be limestone, slag, or other equally hard stone, clean and broken to pass through a two-inch ring. The stone shall be thoroughly drenched with water, then incorporated immediately with the mortar in such quantities that, when rammed, free mortar shall appear upon the surface. Concrete shall be evenly spread upon the foundation, and rammed with wooden rammers until it is thoroughly compacted, and has a clean mortar surface, which surface shall be 5½ inches below the grade of the top of the finished pavement.

Sand Cushion.—After the concrete is properly set, one inch of clean bar sand shall be evenly spread upon it.

Bricks and Blocks, and How Laid.—The bricks or blocks must be vitrified clay, repressed and especially burned for street paving, and not less than 9 inches long, 4 inches wide and 3 inches thick. They may have 2 or more ribs or projections upon one of the vertical sides, extending from top to bottom, and, on the opposite vertical side, a groove or channel extending longitudinally from end to end of the brick or block, and connected with a like transverse groove extending across each end. Other vitrified bricks, however, may be used if not inferior in quality.

They must be set vertically on edge, close together, in straight rows across the street, excepting at intersections, which shall be paved at an angle of 45 degrees, to the line of the intersecting roadways, breaking joints. Half-bricks can be used only at curbs to break joints. The pavement must then be rolled and the joints between the bricks filled with Portland cement grouting, composed of one part fresh ground Portland cement and one part clean bar sand, mixed to the proper consistency with water.

COLUMBUS.

Grading.—The roadbed is to be excavated to the required depth, soft and spongy places dug out, refilled with bank gravel or broken stone and thoroughly compacted by rolling or ramming.

Sub-Drains.—A sub-drain shall be placed on each side of the roadway, 2 feet from the curb lines, 4 inches in diameter, of hard-burned, vitrified drain tile, laid 1 foot below the sub-grade, after after which the trench must be refilled to the level of the sub-grade with screened gravel. If the roadway is made with a cement grouting, drain tile shall be laid in the center of said roadway.

Foundation.—This may be either of broken stone or concrete. The broken stone shall not measure more than 2½ inches, to be spread in a layer upon the sub-grade, then covered with bank sand and compacted by rolling with a ten-ton roller. The thickness of said layer, after being compacted, to be at least 8 inches.

If concrete foundation is used, it shall be 6 inches in thickness, and composed of one measure of best hydraulic cement and two of clean, sharp, river sand, mixed dry and made into mortar with the least possible amount of water. Crushed boulders, limestone or other equally hard material, clean, drenched with water, will then be incorporated immediately with the mortar, in such quantities as will give a surplus of mortar when made.

Cushion.—Upon the concrete shall be spread 2 inches of clean, sharp sand.

Bricks and How Laid.—The bricks or blocks must be hard-burned, of uniform size, free from flaws, cracks or breaks. Broken bricks are to be used only at the curbs to break joints. The brick shall be laid in straight lines at right angles to the curb, except at street intersections. Paving to be thorougly rammed with a 75-pound rammer.

Filler.—The joints or spaces between bricks to be filled with coal-tar paving cement, ordinarily numbered 6, heated and used at a temperature of at least 300 degrees Fahrenheit. Surface of the paving when completed to be covered with a half-inch dressing of sand.

DES MOINES.

Two styles of brick pavements are in use in this city, namely, one course of brick on concrete, with paving cement filler, and two courses of brick on sand foundation with sand filler.

Grading.—The surface to receive the pavement shall be brought to the proper height and shape and thoroughly rolled. Soft spots

shall be thoroughly tamped and filled with sand or gravel and rolled.

Foundation.—If concrete foundation is used, it shall be 6 inches deep, composed of one part of best Milwaukee cement, two parts clean, sharp sand, and five parts of broken stone; stone to be clean, tough and angular, not larger than 2½ inches in their greatest dimensions, and not less than ½ inch in their smallest dimension. On the concrete shall be spread a 2-inch layer of clean, sharp sand.

If sand foundation is used, it shall be 5 inches deep, made smooth, and brought to the proper curvature.

Laying the Brick.—If concrete foundation is used, one course of standard size paving bricks, 8¼ x4 x 2½ inches, shall be set on edge in courses at right angles to the direction of the street, breaking joints.

If sand foundation is used, two courses of brick will be laid, the first layer flat-wise, in courses parallel to the direction of the street, and breaking joints. The joints shall be swept full of clean, fine sand, and covered with a one-inch sand cushion. The top course of brick shall be laid upon edge in courses at right angles to the direction of the street, breaking joints.

Filler.—If concrete foundation is used, the joints between bricks shall be filled with paving cement, containing not less than ten per cent. of asphalt, and heated to 300 degrees Fahrenheit. The surface of the pavement shall then receive a slight sprinkling of sand.

The top course of brick in double-course brick pavement on sand foundation shall have all joints and open spaces swept full of clean river sand, and the surface entirely covered, one-half inch deep, with the same.

MEMPHIS.

Foundation.—Upon the sub-grade surface shall be spread a concrete foundation composed of one measure of fresh-burned cement, and two of clean, sharp sand, mixed with fine gravel and hard blue or flinty gray limestone, broken or crushed to pass through a 2½-inch ring. Sand and cement to be mixed dry and made into mortar with the least possible amount of water, and macadam added in such quantities as will leave a surplus of free mortar when well rammed. Wet or spongy places in the sub-grade to be filled with

concrete. Depth of the concrete foundation to be not less than 8 inches, and the top surface of the same to be 5 inches below the finished surface of the pavememt.

Sand Cushion.—On the concrete foundation, when well set, a sand cushion 1½ inches deep shall be spread.

Laying Pavement.—The bricks are to be laid on edge at right angles to the line of the curb, and in parallel lines, with as close contact as possible on sides and ends, with joints broken by starting at curb lines with half bricks in alternate rows. Street intersections shall be laid at an angle of 45 degrees, pavement to be thoroughly rammed three times with a 40-pound rammer, and the interstices filled with No. 6 distilled coal tar pitch containing not less than 10 per cent. of pure Trinidad asphalt, heated to about 300 degrees. Upon this must be spread one-fourth of an inch of clean, sharp sand, made perfectly dry by heating, and also to be hot when applied to the surface of the pavement. The hot sand must be thrown over the boiling pitch as rapidly as the pavement is filled in, the object being to make the pavement a solid mass and practically water-tight.

TESTING PREPARED TAR.

*By Herr C. Lunge.**

PREPARED tar products are mixtures of coal-tar pitch with distillates of coal-tar in varying proportions. After the volatile products have been distilled from the tar, the hard pitch remaining in the still is difficult to remove, and its use, in the hard state, is very limited. It may, however, be utilized by adding to the still fluid pitch some of the heavy oils, which are of little value for other purposes. According to the quantity and quality of the oils so added, semi-hard or soft pitch, asphalt, varnish for iron, or "prepared tar" can be produced. The latter term was probably at first applied to a preparation for roofing felt, etc., its advantages being that, the volatile constituents having been removed, it was free from smell and not liable to crack in drying. For both the manufacturer

* Translated from *Journal fuer Gasbelenchtung.*

and user it is a great advantage for the benzol, phenol, naphthaline and anthracine to be removed without decreasing the usefulness of the prepared tar, especially as, by regulating the quantity of oil added, any required consistency can be obtained. As under the term "prepared tar" many various compounds may be understood, it is desirable, in order to avoid disputes between the manufacturer and purchaser, to define what in each case the composition should be.

In a case in which the author had to give a professional opinion it appeared that this was not defined, and the following proceedings are now proposed:

Three samples of prepared tar, of German and Polish origin, were obtained, and these will be referred to as samples *A*, *B* and *C*.

In making such tests, the use to which the tar is to be applied should be borne in mind, and the test should also be simple and rapid. Many of the properties of the tar, such as the quickness in drying, covering capacity, resistance to weather, etc., can not be easily determined in laboratory experiments, but they at least admit of the uniform composition of different deliveries being ascertained, and of their agreement with a normal sample. As an easy and accurate mode of testing, three points should be determined, namely, the specific gravity, the viscosity, and the quantity of volatile matter. For the determination of the specific gravity, it is proposed to use a specific gravity tube, with a glass stopper having a small groove filed in the side; the tube is filled with the tar to be tested and the stopper inserted, so as to force the superfluous tar through the groove; after weighing, the tar is poured out, and the vessel is cleaned by wiping out with blotting paper and a little oil. Thick tar frequently contains air bubbles, which can only be separated by continued heating. The operation may also be effected by partially filling the tube with tar and weighing. Let (a) represent the weight of the empty tube, (b) its weight filled with water at 59° F., (c) the weight filled to about ⅔ its height with tar, and (d) the weight when the remainder of the tube is filled with water. The tube, with the stopper removed, is stood for an hour in hot water until all the air bubbles are expelled and weighed after cooling. The required specific gravity of the tar will then be equal to:

$$\frac{c - a}{b + c - (a + d)}$$

By this means the specific gravity of the tar, sample *A* was found to be 1.1649 at 64.4° F., of sample *B*, 1.1972 at 73.4° F., of sample *C*, 1.2424 at 68° F.

With prepared tar, the viscosity is in many cases of much importance; this can not be determined in the manner usually adopted for oils, etc., and a specially designed hydrometer was used for the purpose, the rate at which the instrument sank in the tar at a fixed point being taken as a measure of viscosity. The instrument differs from ordinary hydrometers in being made of very stout glass; the body is cylindrical with a semi-spherical lower end; it is about 4 inches long and 0.8 inch external diameter, and is surmounted by a stem 8.9 inches long and 0.3 inch diameter. On this, 0.6 inch above the conical neck, the specific gravity of 1.400 is marked, and the specific gravity figures are continued upwards to 1.050, which occupies altogether a length of 7.5 inches, the most important part of the scale, up to 1.250, being at a distance of about 3.2 inches from the neck. The instrument is weighted with shot, held in place by sealing wax, and it weighs about 600 grains.

The tar to be tested is put in a cylindrical vessel to such a height that, when the tester is inserted, the vessel is nearly full; the tar is then well mixed and the temperature determined, the cylinder is then stood in cold water until the tar reaches a temperature of 59° F. The tester is then inserted up to the mark 1.250, withdrawn and allowed to drain. A seconds watch is then taken in one hand and the tester in the other. The latter being held so that its lower end touches the surface of the tar, and it is let go when the seconds hand reaches zero. The tester sinks rapidly until the contracted portion is reached, and then goes much slower; when the mark 1.250 is reached the time is observed, the instrument is then taken out and allowed to drain for two or three minutes, after which a second observation is taken. Three or more observations should be made and they should agree within two or three seconds. The point 1.250 is sufficiently below the specific gravity of a normal prepared tar, so that the hydrometer sinks very slowly at last, and it is found that small differences in the weights of the testers do not materially affect the results. With tar *A*, at a temperature of 59° F., the sinking of the instrument varied in time between 34 and 37 seconds, and at 76° F. the time was from 10 to 12 seconds.

With tar *B* at 59° F. the time occupied was from 69 to 72 seconds, at 72° F. 40 to 41 seconds, and at 74.3° F. 32 to 33 seconds. Tar *C* was barely fluid at ordinary temperatures and could not be satisfactorily tested in this manner, as at 74.3° F. the instrument took several hours to sink to the 1.250 point.

With regard to the volatile constituents, it would probably be sufficient to stipulate that a prepared tar, at a given temperature should yield a certain quantity of distillates; but there are many practical difficulties in determining this; the boiling points of some of the constituents are above that of mercury, and any thermometer, even if made of hardened glass, would become incorrect with use.

A preferable plan is to distill 100 grams in a hard glass tubular retort over an open flame, until a determined quantity of the volatile compounds has passed over; the specific gravity of the distillate is then determined, and, after, cooling, the retort is broken and the specific gravity and softening point of the pitch ascertained. If the first trial does not yield a normally hard pitch, another test is made, the distillation being continued for a longer or shorter time, as the conditions of the first trial indicate to be necessary. A second, or, at the most, a third test will give the required test.

The following examples illustrate the operation: From 100 grams of tar, *A* 50.2 cubic centimeters (3 cubic inches) of oil were distilled of 0.063 of specific gravity, or 53.4 per cent. by weight of the tar; the specific gravity of the pitch being 1.2938 at 73.4° F., the pitch having a dull luster, and would not soften in water at 208° F., which proved it to be hard pitch. In a second trial, 44 cubic centimeters (2.68 cubic inches) of oil, of specific gravity 1.040, or 45.7 per cent. by weight, were distilled off. The specific gravity of the pitch was 1.2852 at 68° F., and it was difficult to knead at 163° to 167° F.; at 184° F. it was quite soft, and it melted at 208° F., showing it to be somewhat too hard. In a third trial, 40 cubic centimeters of oil were distilled off, the specific gravity being 1.041, or equal to 41.6 per cent. by weight of the tar. The remaining pitch had a specific gravity of 1.2704 at 73.4° F.; it was difficult to knead at 122° F., and very soft at 140° F., and was therefore somewhat below medium hard. From this it is concluded that this prepared tar contains about 43.5 per cent. by weight of oil and

56.5 per cent. of fairly hard pitch. Similar particulars are given for tars *B* and *C*.

From such tests certain definite conditions may be fixed for estimating the quality of the prepared tar, such as the specific gravity, the viscosity and the quantity of volatile compounds. In most cases three tests will be found unnecessary, as the specific gravity and the viscosity will suffice for determining the value.

CURRENT INFORMATION.

AN OFFICIAL REPORT ON GARBAGE DISPOSAL PROCESSES.

WASHINGTON, D. C., July 18.—[Special to PAVING AND MUNICIPAL ENGINEERING.]—The Health Office of the District of Columbia has requested Dr. Woodward to report to the commissioners the result of his recent trip in search of a satisfactory cremation process for use of the garbage service here.

He first visited the Rider furnaces in Allegheny and Pittsburg. In Allegheny each householder is obliged to employ his own collector, and he delivers it to the public garbage furnace. The ordinary city waste is burned, as well as the garbage. Dr. Woodward says that after witnessing the destruction of the city waste, barrels filled with material more nearly resembling what is known in Washington as garbage was dumped into the furnace, and after this twelve barrels of exhausted tanbark, fresh and damp. The combustion was rapid and complete, and no odor could be detected. The operation during the period of six years of this furnace has been satisfactory to the health authorities.

In Pittsburg the fuel used is natural gas and the material is pure garbage. This crematory is overworked and nothing good can be said of its sanitary arrangements. The health officer says he does not feel justified in forming an opinion as to the ability of these furnaces to burn such garbage as is collected in Washington.

An elaborate plant intended to handle some of the garbage of Pittsburg is in course of erection there, but at present the establishment, and others like it at Philadelphia and Brooklyn, are yet in the experimental stage. It is called the American reduction process.

In Cincinnati the garbage and dead animals are disposed of—one by cremation and the other in a rendering establishment. This is according to the Simonin reduction system. Wooden storage bins receive the garbage first, then it is spread on open frames to prevent packing. The frames, when full, are placed in iron cylinders containing a steam coil. These cylinders are hermetically sealed and warm naphtha pumped into them from a tank. By the means of steam the naphtha and water in the garbage are distilled over into a condenser and separated. The grease dissolved settles to the bottom of the cylinder. This process is repeated several times, and the grease is then drawn off into a settling tank. Later the separated grease is drawn into a storage tank. The dry garbage is now ground and sold to manufacturers of fertilizer for mixture with phosphates.

The odors from this place were marked 500 feet away, and Dr. Woodward says the establishment, in his opinion, is a nuisance, no provision having been made in this particular instance for the artificial ventilation of the building. This is not due to any defect in the system of reduction.

The most complete garbage plant, says the health officer, is the Merz system in St. Louis. The dead an-

imals are rendered at another plant. The plant reduces 180 tons of garbage a day. The material is dumped directly into large tanks, from which it is drawn as needed, the tin cans, etc., being picked out and the residue dried by steam. It is then passed into a coarse screen, the remainder being milled and passed into large iron tanks, where the grease is extracted by means of naphtha and this grease collected in storage tanks, and the residue known as tankage, bagged for sale to manufacturers for fertilizing.

Gases are passed through condensers and the non-condensable portions passed through furnaces. There are large ventilating flues into which all foul gases are drawn by means of fans. The gases are carried through the fires under the boilers and are there decomposed. The board of health of St. Louis considers this establishment a remarkable one. No odor penetrates to the outside. The sanitary condition, says Dr. Woodward, depends upon the system of ventilation, not upon anything peculiar to the Merz process.

In conclusion Dr. Woodward says that he is unable to find that either of these processes, the Simonin or Merz, has any sanitary advantage over any other, except possibly there is a little more handling of the raw garbage by the Simonin process. Under similar circumstances, with equally expensive and complete plants, both systems would show equally well.

Neither of the processes could be operated in this city without means for condensing or decomposing all offensive gases, including those arising from the garbage itself while being dumped from the carts and from its products wherever exposed to the atmosphere. The health officer would recommend that in any such establishment all ventilation be secured by flues for that purpose and not by the windows or doors, and that all air from the foul air ducts be exposed to these fume cremators of some sort. With these precautions he thinks that either the Simonin or Merz process could be operated without nuisance if under rigid supervision of a competent superintendent.

A NEW SYSTEM OF STREET IMPROVEMENT DISTRICTS IN ST. LOUIS.

The St. Louis Board of Public Improvements has determined to adopt a definite system of street improvements, similar to one which was inaugurated about ten years ago, for the paving of the central district with granite. The move has been contemplated for some time, and came to an issue a few days ago on the question of allowing a permit to the Rich Construction Company to put a telford pavement on Clemens ave., between Hamilton and Goodfellow. The board then determined to "lay out definite districts within which no ordinances for inferior construction will be recommended, and no permits for construction by private contract will be given." The Committee on Streets and Railroads was instructed to lay out such a scheme of districts.

This step is regarded by the board as the most important it has yet taken. "The growth of the city," says President McMath, "has made a systematic redistricting of improvements absolutely necessary. The old business district, paved with granite in Commissioner Turner's time, is now too small. The big factories in the neighborhood of Twentieth street, and the large Cupples' buildings, will necessitate an enlargement of the granite district to a considerable extent.

The districts used for a medium amount of traffic will be paved with either vitrified brick or asphaltum, the general wearing capacities of these two substances being about alike. This district will not be so easily definable. Finally, there are the boulevard districts, for which the improved telford paving will be used. This material enables horses to obtain a surer foothold than upon the asphalt or vitrified brick."

Street Commissioner Milner, the chairman of the committee to whom this districting has been allotted, says that the redistricting will be slowly and carefully done, as it is expected to continue in force for a number of years.

"By this redistricting," said the commissioner, "citizens will know just where they stand in the selection of houses. Our street improvement is in need of a radical change. We have now 328 miles of streets improved with macadam and telford pavement. Both of these materials are out of date and cost a great deal for maintenance, as they require extra cleaning and sprinkling. The improved telford pavement, which has a top dressing of four inches of crushed granite, is now considered the best material for light wear, and vitrified brick and asphaltum for heavier wear. In the end it will be a saving to the city if these materials are employed."

The board of public improvements has during the last summer adopted ordinances for the paving of twenty streets with vitrified brick, all practically included in the region bounded by Laclede, Vandeventer, Easton and Clarenden avenues. The total length of these streets that will be paved with vitrified brick is 35,177 feet or about 6⅔ miles. The total area covered is 1,248,700 square feet. The streets on which the bulk of the improvement will be done are Taylor avenue from Lindell boulevard to Easton avenue, Euclid avenue from Easton to Greer avenue, and Sarah street from Laclede avenue to West Belle place. Other long stretches are on Maryland avenue from Boyle to Euclid avenue, and on Delmar avenue from Taylor avenue to King's highway.

RAILROADS ASSESSABLE FOR PUBLIC IMPROVEMENTS.

Judge Arnold, of the Philadelphia Common Pleas Court, rendered a decision on July 23d, holding that a railroad company is taxable for the cost of the construction of a sewer on property abutting on freight yards, etc. While the bed, bank, or towpath of a canal, or the roadbed of a railroad can not be so taxed, he holds that property owned by railroads and used for offices, depots and car houses are subject to such taxation.

PROTECTION OF PAVED STREETS.

The New Orleans city council has passed an ordinance providing that when Henry Clay avenue in that city is paved it shall not be disturbed for a period of five years afterwards. Property-owners who fail to put in gas and water pipes before the work is begun will not be permitted to cut into the pavement for this purpose afterwards. The New Orleans *Times-Democrat* says that the streets of that city have suffered much heretofore from the reckless manner in which corporations have been permitted to make excavations, and cites an instance of one street which during the last year has been almost completely ruined by the street railway, gas and water companies, which

have, at different times, cut into it, and, of course, have not repaved along the line of their excavations as well as the work had been done before. The loss falls on the property-owners who paid for the improvement of the street and the ordinance which has just been passed is for their protection.

SAGINAW'S NEW RULE REGARDING STREET PAVING.

The council committee on street paving of Saginaw, Mich., has adopted a rule requiring that a year's notice shall be given to the water board when a street is to be paved, in order that pipe-laying and other underground work may be done a sufficient length of time in advance to allow a compact settlement of earth where trenches may be dug and thus assure uniform solidity of the foundation of pavements.

LIMITATION OF SEWER ASSESSMENTS.

Assessments for the construction of sewers in Philadelphia can not be levied upon abutting property-owners in sums larger than are required for the proper drainage of their own street. So Justice Mitchell has decided in the supreme court. In other words, a 10-inch sewer being amply sufficient for all the drainage, property-owners can not be assessed for a 15-inch sewer to accommodate the drainage of adjacent streets.

COST OF CLEANING NEW YORK'S STREETS.

The thorough work which Col. George E. Waring has been doing as street commissioner of New York has necessarily cost more money than usual, and this led to charges of extravagance early in the season. An investigation was made by the Board of Estimate and Apportionment, with the result that Col. Waring's management of his department has been strongly commended by all of the investigating officials, with the exception of Comptroller Fitch, who criticises him simply for not keeping his expenditure within the appropriation. The answer seems to be that Col. Waring, in accordance with what he has understood to be his duty, has been keeping the streets clean, and has relied on the city to provide whatever money was necessary to do this. This is the city's duty, and it has no cause of complaint so long as the commissioner's work is well done, and his expenditures are carefully and honestly made.

The investigating committee's report showed that there was appropriated for street cleaning purposes $2,396,000, and that Col. Waring had spent a great deal more each month than one-twelfth of this appropriation. At the present rate of expenditure the deficit at the end of the year would amount to $601,000.

There are no methods by law by which extra money can be appropriated for meeting this deficit, unless the board of health declares that it is necessary for the health of the city to keep the streets cleaner.

In view of this fact the committee recommended that a copy of the report be sent to the board of health, and if the board of health believed it would be dangerous to health to reduce expenses for the rest of the year so as to make up the deficit by economy, then, on their recommendation, they would make an appropriation covering the deficit.

The report showed that Col. War-

ing had spent since assuming office a monthly average of $238,155.95. For June the expenditure was $238,000. It would be necessary for the rest of the year to spend only $152,000 per month to keep the expenditure down to the original appropriation.

PENNSYLVANIA HIGHWAY IMPROVEMENT LAW.

At the last session of the Pennsylvania Legislature, a bill by Senator Flinn, of Pittsburg, was passed, providing for the permanent improvement of public roads and highways, to be paid for by special tax levy. It was expected that much work would be done under this law in improving the highways of Allegheny county, but when the county commissioners met recently to pass resolutions authorizing the employment of engineers for preliminary work at an expense not exceeding $10,000, the comptroller protested on the grounds that public funds could not be used for the necessary preliminary expenses, and, of course, the work could not be undertaken without the surveys. Senator Flinn charged that the whole purpose was to prevent the improvement, and himself offered to loan the county the money for the expense of the preliminary surveys, but this the comptroller also refused to give his consent to. There is much disappointment over this turn in what promised to be an important public enterprise, but there is yet hope for a satisfactory arrangement which will enable the work to proceed.

A STUPENDOUS PURE WATER SUPPLY PROJECT.

A. J. Marfin, a Cleveland lawyer, proposes a solution of the water supply problem of cities in the middle states by utilizing the water of Lake Huron, into which no sewage empties. He suggests that the United States government build a large acqueduct through the neighboring states, from which the different cities will take their supply and pay therefor a charge which will be both to the advantage of the consumers and the government.

MACADAM PAVING IN AMERICAN CITIES.

Mr. George H. Blakeley, C. E., in discussing the subject of street paving in a recent address before the Paterson, N. J., Board of Trade, dwelt particularly on macadam, as it is the material most largely in use there, and this is mainly because the supply of rock is conveniently at hand. The cheapness of first cost has been its chief recommendation. The comparative cost in different sections of the country is indicated by the following statistics quoted by Mr. Blakeley:

City.	Population.	Miles of Macadam.	Costs sq. yd.
Cambridge, Mass	70,000	70	$0 70
Nashville, Tenn	76,000	111	45
Hartford, Conn	53,000	64	1 00
Rochester, N. Y	134,000	46	1 25
Toledo, Ohio	81,000	10.4	1 23
Albany, N. Y	95,000	1.7	....
Newark, N. J	182,000	10 8	1 75
Trenton, N. J	57,000	0.5	....
Paterson, N. J	78,000	88	45

In discussing macadam, with especial reference to its local use in street paving, Mr. Blakeley said: "The advantages of macadam are as follows: A good foothold for horses; comparatively easy traction when in good condition; moderate first cost and comparative noiselessness. The disadvantages are: muddy when wet, dusty when dry; excessive cost of maintenance under the heavy traffic of city streets, and the impossibility of keeping them clean. The defects alone condemn the use of macadam for city streets, but when properly constructed and

maintained they are the best pavements, the safest and most economical for suburban streets.

"Wherever macadam pavements have been tried for heavy traffic streets it has been the almost uniform experience that they are inadequate and more permanent pavements substituted, whose maintenance costs less and which permit of cheap and easy methods of cleaning. Clean, well-swept streets add materially to the prosperity of a city, and have an important effect upon the health of its inhabitants. Dusty streets are injurious to health from the air laden with dust particles rising from them, which when inhaled produces pulmonary diseases. Professor Tyndall is authority for the statement that street dust contains the germs of bacteria of putrefaction. Persons living in dirty and unwatered streets are unable to open doors and windows by reason of the dust.

"Many of the streets in Paterson are cleaned but twice a year. A pavement cleaned but twice a year is clean only twice a year. A clean macadam pavement wears longer than one covered with mud or dust. In dry weather macadam pavements require sprinkling constantly, not only to allay the dust, but as a measure of economy in their maintenance. It costs $28,000 a year in Cambridge, Mass., to maintain and clean twenty miles of macadam streets in a proper manner.

"Economical maintenance and not first cost is the true test of economy. The excessive cost of maintenance of macadam pavement on city streets has driven many another city to abandon it and replace it with a more adequate pavement suited for much used streets, and one that can be maintained at less cost and easily cleaned."

KINDS OF TROLLEY CAR RAILS USED IN PHILADELPHIA STREETS.

Grooved rail used by the trolley car companies at intersections of asphalt-paved streets. Weight, 70 pounds per yard.

Standard steel rail used by the trolley car companies. Weight, 90 pounds per yard.

Curved guard rail used in all curves by the trolley car companies at intersections of asphalt-paved streets. Weight, 82 lbs. per yd.

NEW YORK'S CAMPAIGN OF EDUCATION IN STREET CLEANING.

The street cleaning department in New York is conducting a campaign of education among the little folk of the east side. They are to be taught to wear small tin badges and reprove janitors who disobey the ordinance relative to ash barrels. When they see a man throw banana peels on the sidewalk they are to call his attention to the law. If the man still persists in his wickedness the children will pick up the banana peels themselves and deposit them in an ash barrel as a practical and well-timed rebuke. If this does not shame the man he will be put down as incorrigible. The movement began June 30, when Miss Julia Richmond, chairman of the directors of the Hebrew Institute, at Jefferson street and East Broadway, trod on a misplaced banana peel on Hester street. She began to tell the youngsters where the peel should have been deposited, and then the campaign of education got under way.

CONNECTICUT'S NEW HIGHWAY LAW.

The Connecticut Highway Commission has fixed August 15 as the date when towns can begin to avail themselves of the new improvement law, and has decided to place on file each application from the towns in the order in which they are received, and the expenditures will be made in this order until the appropriation is used up. The appropriation is $75,000. Some idea of how far it will go may be obtained from the fact that it costs about $5,000 a mile to construct good macadam or telford roads in Connecticut. Towns availing themselves of the act are to pay one-third of the cost, and, therefore, not more than forty-five miles of roads can be constructed by the commission with its present appropriation. Chairman McDonald says: "Judging from the facts that I have obtained in looking up this matter, the towns in this state expend annually about $1,500,000 for highways, in building and maintaining roads, and any one who has had occasion to drive through the state knows how far this expenditure has gone toward making good roads. But much of the money has not been utilized to good advantage, because the work on the roads has been political jobs. Under the new law all work must be done by contract."

PUBLIC-SPIRITED STREET CLEANING IN SAN FRANCISCO.

The Merchants' Association of San Francisco, which has given special attention to the improvement and care of the streets of that city, has recently sent out a large number of circular letters asking the opinions of business men and property-owners as to the best methods of improving the streets and conducting the municipality. Over six hundred replies have been received up to this time. The letters have been unanimous in favoring clean streets and against cobble-stone paving. On the question as to whether the city should pay for repairing cobble-stone, the answers were to the effect that the property-owners should pay half. The same answer was made to the question regarding the paving of streets with bitumen. The expression generally was in favor of paving the city streets before building boulevards to suburban points. All favored a commission for a perfect system of sewers.

During the last month the association has spent $4,000 in sweeping the streets, as a demonstration

of what can be done. Superintendent of Streets Ashworth has objected to the work done by the sweeping machines. The association, in a communication to him under date of July 13th, said that the faulty work of the sweeping machines was due mainly to obstructions, such as vehicles, piles of material, etc., which had been left on the streets contrary to ordinances. The association says, "The rejected work, as a whole, making due allowances for the conditions mentioned, is fully up to any machine work ever done in this city. The condition of the district swept by the machines is better than it ever was at any time previous to our beginning operations, and the business men and residents of these districts have thanked and highly complimented us for the improvements made."

RIGHT TO CONTRACT FOR A PARTICULAR KIND OF PAVEMENT.

The New Jersey Court of Errors and Appeals has rendered an important decision on the right of municipalities to contract for a particular kind of pavement. In July and August, 1892, the board of street and water commissioners of Newark, by ordinance, authorized the paving of certain streets with "genuine Trinidad lake asphalt," and invited bids therefor. The Barber Asphalt Paving Co. and the New Jersey Asphalt Co. each submitted bids, the proposal of the New Jersey Asphalt Co. being slightly lower than that of the Barber Co. in each case. The charter of Newark declares that "all such contracts for street improvements shall be awarded to the lowest bidder, unless it shall appear * * * that the interests of the city or of the property-owners interested will not be advanced thereby." The board reserved the right to reject any or all of the bids. After six months of investigation, the board rejected the lower bids of the New Jersey Co. and accepted those of the Barber Co., basing this action on the ground that the New Jersey Co. had failed to produce, or prove its intention to use, "genuine Trinidad lake asphaltum," and that it had no established plant or works to properly perform the contract. Suit was then commenced to review, by *certiorari*, the action of the board in awarding the contract to the Barber Co. The principal claims made by the New Jersey Co. in this proceeding were as follows: (1) That "land asphalt" was "just as good" as genuine Trinidad lake asphalt, and consequently could be substituted for it; (2) that because the Trinidad Asphalt Co., a separate and independent corporation, had obtained from the British government the sole right to take and sell genuine Trinidad lake asphalt, such proprietary holding constituted a monoply and consequently there could be no competitive bidding for pavements made of that material; (3) that the contract should, in any event, be awarded to the New Jersey Co. as the lowest bidder.

The court held that the testimony, which filled 500 printed pages, proved that the board had made a careful investigation, and had acted as it believed was for the best interests of the city. It is held that when a conclusion by city officials, affecting proposed contracts, and when reached in good faith and after careful investigation, will not be disturbed by the courts.

Commenting on the testimony attempting to establish a monopoly in Trinidad lake asphalt the court said: "The only question of law

raised by reasons on file is that the material called 'Trinidad Lake Asphaltum' is a propietary article and a monopoly in which there can be no competition. In point of fact the latter statement is not sustained by the proofs. Upon the facts proved the legal proposition is that a municipality may not contract for the material it deems most suitable for its purposes if it be potential on the subject of exclusive ownership or control, for that is what the contention comes to. Such a proposition can not be said to be sustained by any necessary or even by any legitimate implication to be drawn from the legislative prescription that 'all contracts shall be awarded to the lowest bidder,' especially when modified by the proviso 'unless it shall appear that the interests of the city or of the property-owners will not be advanced thereby. * * * The primary objects of care in the legislative provision for competition are the public and private interests committed to municipal agencies, not the convenience of contractors or the protection of their profits. * * * There is in the present case nothing to show that the proposals were not invited in good faith, nor that the specification of material was not in point of fact for the best interest of the city. In such a state of affairs, the city is not legally debarred from contracting for what it wants merely because the desired material is the subject of private ownership or the product of exclusive manufacture."

MUNICIPAL OWNERSHIP OF WATER-WORKS.

The agitation in favor of municipal ownership of water-works is vigorously continued in many cities. During the last month Oneida, N. Y., has agreed to pay $148,000 for the water-works in that city. After twelve years of warfare the owners of the water-works at Atlantic City have agreed to sell to the city for $775,000. By a vote of 136 to 92 Bennington, Vt., has determined not to buy the plant in that city. The agitation at Denver in favor of the purchase of the water-works is particularly strong now, in consequence of the recent difficulties growing out of the new rates established by the water company.

APPROPRIATION FOR HIGHWAYS IN MASSACHUSETTS.

The appropriation for highway construction in Massachusetts under the new commission is, for the next year, $400,000. No persons but citizens of the commonwealth may be employed on the work.

A COMPARATIVE TEST OF BRICK AND GRANITE.

For the purpose of demonstrating by comparison the qualities of vitrified brick and granite block, an experiment is to be made in Cincinnati, by paving with both materials in front of the Chamber of Commerce, thus putting them to equal tests.

MUNICIPAL REPORTS.

Boston.—City Engineer Jackson reports that the improved sewerage system of Boston has cost $6,307,754.96, leaving a balance of $67,650 of the total appropriations.

Burlington, Ia.—The annual reports of the city officers of Burlington, Ia., have just been published in a pamphlet of 105 pages. Mayor Buttles recommends the continuance of public improvements, and congratulates his constituents on the thorough, systematic and economical administration of this de-

partment of work by the city engineer and street commissioner. City Engineer Steyh's report shows that during the fiscal year the work under his direction comprised 28,657 square yards of brick paving, 1,750 square yards of macadam, 567 square pards of limestone block paving, 9,752 lineal feet of stone and 500 feet of granite curbing, at a total cost of $50,445.63. The city now has 24.98 miles of curbing, 8.56 of brick pavement, 7.43 of macadam, 1.40 of limestone block, .011 of granite block, making a total of 17.50 miles of permanent paving, which equals about 15 per cent. of all the streets and alleys of the city. There were constructed during the year 12,391 feet of sewers, ranging in size from nine inches in diameter to eighteen feet span, at a total cost of $24,382.41. The sewerage system of the city now comprises 8.61.

Newark, N. J.—The annual report of the street and water commissioners of Newark, N. J., has just been published. Mr. Ernest Adam, the engineer in charge, reports the street paving done during the last year as follows: Granite block, on concrete, 22,818 square yards at a cost of $79,026.04; granite block, on sand, 26,152 square yards at $69,933.37; sheet asphalt, 3,248 square yards at $9,227.84; oblong trap block, 17,430 square yards at $43,140.69; cobblestone, on concrete, 2,481 square yards at $7,028.85, making a total of 73,069 square yards at a cost of $208,456.79.

The city now has sixty-five miles of paving, and 139 miles of unpaved streets. Mr. Adam advises that some of the telford streets now in bad condition be covered with asphalt. "This," he says, "would not only avoid a heavy annual expenditure for repairs, but also abate the intolerable nuisance of dust in dry weather." He further says in his report to the commissioners, "it might be well to put down brick paving in a few streets where the traffic is not heavy and where the value of abutting property would not warrant the expense of a more costly paving. I believe that brick paving upon a 4-inch concrete foundation, and the interstices filled with cement-grout could be put down for about $2 per square yard."

The sewer construction during the last year comprised 2,931 feet at a cost of $20,662, and the city now has 112 miles of sewerage.

Williamsport, Pa.—In the annual report of the city officials of Williamsport, Pa., Mayor Elliot mentions the availabilty of a fund of $100,000 for the construction of a system of sewers, and congratulates the public on the progress in street paving which has "aroused a healthy public sentiment favorable to a continuance of this work —a sentiment that should have a direct influence in actuating and impelling an exhaustion of the resources at command in constructing permanent improvements of this form." He says the macadamized streets are rapidly failing and advises that they be used as foundations for brick paving. City Engineer Snyder reported that the street paving during the last year cost $46.856.66. These were brick pavements laid under a guarantee of ten years, at $2.24 and $1.80 per square yard. The city now has five miles of paved street. The sewer construction of all kinds during the year amounted to 8,525 feet. The engineering department was equipped with a cement testing machine which, Mr. Snyder says, has resulted in the use of a superior grade of cement in all the contract

work of the city. He recommends that the street commissioner be required to report full data as to the cost of cleaning and repairing streets, which has not been done heretofore, and says: "The true cost of pavements, sewers, etc., is not to be measured by the first cost, so much as by the subsequent cost of cleaning and repairs, and the cleaning, maintenance and repairs of these works are no less engineering problems than their original conception and construction."

PERSONAL NOTES.

Mr. John R. Freeman, Winchester, Mass., has been appointed a member on the metropolitan water supply commission.

Mr. John F. Fairchilds has been appointed engineer, and Mr. J. J. S. Croes consulting engineer, of the Bronx Valley sewer commission.

Mr. J. H. Killmar, of the firm of Higgins & Killmar, consulting engineers, Des Moines, Ia., is in charge of plans, specifications and work on the Des Moines river bridge, at Boone, Ia., the cost of which will be $16,000.

Mr. M. K. Miller has been recently appointed street superintendent of Oakland, Cal. He announces that he will advise bituminous rock paving as preferable for Oakland.

Mr. Morris R. Sherrerd, Assoc. M. Am. Soc. C. E., for the past two years city engineer of Troy, N. Y., has accepted the position of engineer of the board of works of Newark, N. J.

Mr. W. H. Delano, general manager of the Compagnie Générale des Asphaltes de France, who has been in the United States during the last summer, has returned to Paris. Mr. Delano states that American capitalists are now forming a strong company for rock asphalt paving in the United States.

Emmet C. Dunn has been chosen city engineer of Alexandria, District of Columbia, as a result of a competitive examination of twenty applicants. The examination embraced geometry, trigonometry, calcalus, the law of real estate, drainage, sewers, sidewalks, roads, gas and the rest of the branches of municipal work coming under the supervision of a city engineer.

ANSWERS TO QUESTIONS.

[By J W. Howard, B. L., C. E., Specially for PAVING AND MUNICIPAL ENGINEERING.]

[Questions upon street construction above, upon or below ground, will be answered in PAVING AND MUNICIPAL ENGINEERING, if of general interest. Address, Question Department, PAVING AND MUNICIPAL ENGINEERING.]

What is the best form or shape for a man-hole cover? *S. J.*

This question probably refers to the shape of the upper portion as seen in place on the street. The best shaped man-hole covers are probably those of Berlin, Germany. They are square but set so that each side makes an angle of 45 degrees to the longitudinal axis of the street; in other words, the cover is set diagonally to the line of traffic, so that the wheels can neither strike it abruptly at right angles nor cause depressions in the pavement by running parallel with either of its sides. The pavement about it is thus preserved intact. The next best shape is a round cover. Square

ones should never be set with their sides parallel to the curbstones or line of travel.

Do you favor high or low curbstones? *T. B. C.*

On well paved streets low curbstones facilitate crossing at any point, and because dirt gathering in the gutters is more quickly noticed than when the curbs are high, low curbstones are incentives to keep a street constantly clean. A city which can afford standard pavements can also afford sewers, and therefore has no excuse for unsightly gutters and high curbstones, as found on a very few streets built years ago in Chicago, Omaha, and Minneapolis. The handsomest streets of Paris and Berlin have curbstones which extend but four inches above the pavements, although six inches is not too high. There are places on many streets where the curbstone must be higher or lower than this, due to the necessary grade adjacent to openings to sewers, or the location of the street along or upon the side of a hill.

Where does Bermudez asphalt come from? *L. M. P.*

It is from the State of Bermudez in Venezuela, and near the north coast of South America.

Which is the best filling for joints of a brick pavement—cement-grout, coal-tar or asphalt? *P. L. S.*

This is a question under constant discussion among brick paving contractors. The advantage of cement-grout over the others is that it will penetrate to the bottom of the joints and cement the bricks together into almost one continuous surface. The coal-tar distillates vary so much, that a general answer can not be given more than to say it seems best to use coal-tar distillate No. 4 or 6. It is claimed that this does not make quite so rigid a pavement as when hydraulic cement is used between the joints. In both cases it is difficult to clean and use the bricks again after they have been removed to gain access to a pipe or for other cause. Indirectly, this is an advantage, for better work will be done by using new bricks, which adds but little to the cost. Asphalt alone can not be used for pouring into the joints. It is too thick. A little asphalt, say 20 per cent., added to the refined tar, makes a mixture which is fluid when heated and very stable when in place; also little injured by the air or the cold of winter and heat of summer.

Should a concrete foundation under a brick pavement be at least six inches thick? *R. M. B.*

In almost every case, yes, if the concrete is composed of cement, sand and crushed stone; but if composed of cement, sand and gravel, it should be a little thicker. An individual brick of a brick pavement, when struck by a passing wheel, transmits the blow directly to the foundation below. The pressure is distributed over an area practically as small as that of the brick, hence it is safe to have at least six inches of concrete for a foundation.

What is the best material and shape for cross-walks or bridge-stones? *Subscriber.*

As a rule granite is the best material, or any granitoid rock, such as syenite or quartzite. Local conditions govern the shape and size. As a rule, however, there should be no joint parallel to the line of traffic. At intersections of streets, the transverse joints of the cross walks, if made to approximately

point to the center of the intersection, will thus avoid being parallel to the line of traffic at any point except at the exact center of the roadways, at which point there should be no joint; in other words, in placing the cross-walks end to end across a street, the joints are best if cut diagonally or beveled. They are so laid in most European cities, and in New York, Troy, and a few other American cities. The wheels of passing vehicles do not then cut furrows between the ends of the cross-walks, to the great annoyance of traffic, foot-passengers and the handsome finish of the street.

Is softness of an asphalt pavement an evidence of defectiveness? *J. R. H.*

This depends principally upon the temperature of the weather during which the softness is observed. An asphalt pavement, as laid in the United States, is generally composed of sand, a little limestone dust cemented together with an asphaltic cement. The asphaltic cement is composed of refined asphaltum tempered with a little residuum oil of petroleum or other flux. The quantity of asphaltic cement varies with the climate, in southern cities less being used than in northern cities; therefore the climate of the place must be carefully studied from accurate records and an exact note of the maximum and minimum temperatures of the place taken before the best mixture for that place can be determined. In some cities of the United States which have long periods of hot weather, asphalt forms but about 10 to 15 per cent. of the mixture; whereas in the extreme north it is increased to between 15 and 18 per cent. Softness in very hot weather is an indication that the pavement will bear cold weather better than it otherwise would. Softness in a reasonable degree is an advantage in an asphalt pavement, all other things being equal and properly cared for.

What does the cracking of asphalt pavements indicate as to their wearing qualities? *G. U. B.*

The previous question, with its answer, throws some light on this one. Many kinds of crude and refined asphalts are very susceptible to heat and cold, softening much under heat and becoming brittle with cold. Such asphalts make pavements which have similar characteristics. The Bermudez asphalt has a tendency in this direction and therefore great care is exercised in the mixtures used and the per cent. of asphaltum which enters into the pavements in different cities with different climates. Trinidad asphalt is less changeable under heat and cold and therefore a little easier to use in making pavements suited to different climates and extremes of weather. An asphalt pavement should be mixed more with a view to its bearing the winter weather than becoming soft in summer. Almost all cracking takes place in winter.

LEGAL DECISIONS.

[Reported Specially for PAVING AND MUNICIPAL ENGINEERING.]

Control of Trees in Street.—Trees growing in a city street are under control of the city, and it may have them cut down, in order to make room for a sidewalk, even though the fee of the street does not belong to the city. City of Mt. Carmel *v.* Shaw (Supreme Court of Ill.), 39 N. E. Rep. 584.

Assessments for Street Improvements.—A previous demand by the contractor, on the property-owner, for payment of an assessment for street improvements, the Appellate Court of Indiana holds, is not a condition precedent to his right to sue to enforce the same. Sloan *v.* Faurot, 39 N. E. Rep. 539.

Petition for Municipal Improvements.—Under the statute, giving municipal corporations power to make public improvements on petition of a majority in interest and number of abutting owners on the line of the improvement, where the proposed improvement is the extension of an already existing street a majority in interest and number of owners of property abutting on the part to be opened, and not on the entire street, is necessary to authorize the improvement. Speer *v.* City of Pittsburgh (Supreme Court of Pennsylvania), 30 Atl. Rep. 1013.

Validity of Ordinance for Regulation of Vehicles.—Under the statutes, providing that the mayor and aldermen, and selectmen, may make such rules for the passage of vehicles in or through the streets of a city as they deem necessary for the public safety, a common council may pass an ordinance that no person shall carry or cause to be carried, on any vehicle in any street, a load, the weight of which exceeds three tons, unless such load consists of an article which can not be divided. Commonwealth *v.* Mulhall (Supreme Judicial Court of Massachusetts), 39 N. E. Rep. 183.

Defective Sidewalks.—A city can not be held to have constructive notice of defects in a sidewalk which are not observable by persons passing over the same. Lohr *v.* Borough, of Philipsburg (Supreme Court of Penn.), 30 Atl. Rep. 822.

Damages for Changing Grade of Street.—In an action by an abutting land-owner against a street railway company for damages for changing the grade of a street in front of his land, the measure of damages is the difference in value of the premises before and after the change was made. May *v.* Carbondale Traction Co.) (Supreme Court of Pennsylvania), 31 Atl. Rep. 667.

When Agreement to Abide by City Engineer's Decision is Binding.—A contract for the improvement of a street provided that, "to prevent all disputes and litigation," the city engineer's decision as to the work shall "be final and conclusive." It was held by the court that one of the parties could not avoid being bound by the engineer's decision by showing merely that he was negligent and made mistakes. Bowman *v.* Stewart (Supreme Court of Penn.), 30 Atl. Rep. 988.

Sewer Builder's Liability for Injuries.—The fact that a party, in digging a ditch along a public way, tapping the private sewer of C, violated a city ordinance intended to prevent the use of the

public sewer without payment of the imposed tax, does not give a right of action to one whose horse was injured by the negligent doing the work. Zimmerman *v.* Bauer (App. Ct. Ind.), 39 N. E. Rep. 299.

SELECTIONS FROM THE PRESS.

CHICAGO STREET PAVEMENTS.

It will be admitted by the oldest inhabitant extant that, while cleaner than usual, the condition of the paved streets of Chicago is otherwise worse than at any previous time in its history, and that the worseness extends over a greater area than ever before. Except upon boulevards it is practically impossible to find smooth or safe driving in any part of the densely populated portions of the city.

Several causes contribute to decay of the streets. Spongy prairie bed is not the best bottom on which to lay any sort of pavement for hard usage. The sharp, narrow tire on freighting wheels will cut any pavement, even granite, in time, and upon soft woods or concrete its deadly work is speedily done. The lack of stable subsoil induces early deterioration of ordinary blocks of wood; stone laid upon insecure bottom fails after a year or two and becomes cruel and injurious to horses.

But more than the frail underbed, sharp tires and the chemical forces that rot wood and dislocate even granite, surface railways are responsible for the present outrageous state of Chicago pavements. Whether to put their own roadbed in better condition for cables or horse cars, or to raise the rails for the new trolleys, the companies have torn up miles of streets throughout the city, and, after accomplishing the special object in view, have left the pavements outside their rails on both sides of the street in unevenness and dilapidation. The result is that driving, which is neither prudent nor comfortable on the rails, is unsafe and difficult on the portion of the street not used by the cars. No attention whatever has been paid to the effect of the new higher grade for the trolley cars, construction of which has left the streets in an acute and irregular pitch to the curb on either side.

The elevated roads are almost as culpable. Wherever they have excavated to put in foundations for their framework they have failed to put the paving back as it was, but have left invaded and torn-up streets in a demoralized condition, as unsightly as perilous.—*From Chicago Times-Herald.*

CALIFORNIA CONTRACTORS CAN NOT BE REQUIRED TO GUARANTEE PAVEMENTS.

When the first pavements were laid in Los Angeles, the bituminous rock contractors and the granite block men had to give bonds to keep their work in good condition for five years. It has been decided by the supreme court that the law which provides for the assessment of frontage to pay the expense of "paving and repaving" a street does not permit the inclusion in the contract of a clause obliging the contractor to keep the street in repair for a term of years. The repairing must necessarily cost money, and any contractor in his senses would take into account the guarantee and charge it in his bid. It is perfectly right that a municipality should

seek to hold a contractor to good work, but the cost of repairs may not be charged to the property-owner under the name of "paving and repaving." It is for this reason that these guarantees can not now be exacted of street contractors; but it is still possible to make them give guarantees of the goodness of the material they use and of the quality of their work.—*The Investor.*

TO A STREET SPRINKLER.

Sprinkle, sprinkle, great big cart,
Up and down the sloppy mart,
Sprinkle, be it cold or hot,
Wet or dry, it matters not.

What though wheelmen wail and weep,
Keep the mud two inches deep.
Let 'er flicker in a flood;
Streets were made for mixing mud.

Ere the golden sun is set,
Make the streets so dog-gone wet,
Those who, in the gloaming dim,
Try to ride will have to swim.

Let 'er sizzle, day by day;
What are streets for any way?
Your job is to keep 'em wet,
And you get there, too, you bet.

Soak 'em to your heart's content,
Till some genius shall invent
Some new wheel to sail the street,
With fins and flippers and web-feet.

—*L. A. W. Bulletin.*

MACHINERY AND TRADE.

Raleigh, N. C., is considering the purchase of a rock crusher.

The purchase of a road-roller is being agitated at Lockport, N.Y.

Hopkinton City, R. I., voted to purchase a portable stone crusher.

Toledo, O., contemplates purchasing several new street sweepers.

Neff's Brick and Tile Plant, Stoutsville, Ohio, will build a new brick kiln soon.

A. T. Griffin has organized a stock company and will rebuild the Utica, N. Y., brick yards.

A company has been organized for the manufacture of paving brick at New Brunswick, N. J.

Easthampton, Mass., has purchased a steam road roller from the Pitts Agricultural Works.

Lafayette, Ind., has decided to purchase a street road-roller of the O. S. Kelly Co., Springfield, O.

The Macomb Sewer Pipe Company's works at Macomb, Ill., burned July 9th. Loss $25,000.

The Warren-Scharf Asphalt Paving Company will erect a plant, to cost $10,000, at St. Paul, Minn.

Piqua, O., has purchased a street sweeper from the International Street Sweeper Company, Dayton, Ohio.

Sixth street, St. Paul, Minn., will be swept by hand six times a week. The work will be done by contract.

A new paving brick company is being organized at Des Moines, Iowa. They will purchase the old Merrill plant.

Frey-Sheckler Company, Bucyrus, O., sold a new augur machine to the Atchison Paving Brick Company, Atchison, Kan.

Newly incorporated companies: Denton Brick Company, St. Louis, Mo.; New Castle Asphalt Block Company, Dayton, O.

George Rund, a farmer, near Monon, Ind., claims to have discovered a deposit of asphalt underlying a strata of stone on his farm, about ten feet below the surface of the earth.

The reservoir committee, Minneapolis, Minn., purchased a ten-ton steam road-roller from the O. S. Kelly Co., Springfield, Ohio.

Kansas City, Mo., has let its street sprinkling contracts to three different companies, at prices ranging from $1.20 to $1.45 per lineal foot.

Edward A. Long, Los Angeles, Cal., has purchased fifty acres of land adjoining Parke City, and will establish a mammoth pressed brick yard.

The Muscatine Terra Cotta and Lumber Company, Muscatine, Ia., will sell its paving brick plant at auction, August 22d, unless sold meanwhile.

The contract to furnish 450,000 paving brick to Van Wert, O., was secured by the T. B. Townsend Brick and Contracting Company, Zanesville, O.

The Don Valley Pressed Brick Works, Toronto, Canada, have just burned their first kiln of paving brick, and they are, it is reported, of excellent quality.

The Iowa Brick Company, Des Moines, Iowa, will build a bridge across the Des Moines river at Fourteenth street, to connect its plant with that thoroughfare.

Mr. E. G. Skinner, treasurer of the Gem City Manufacturing Company, reports having sold a seven-ton steam road-roller to J. G. Shea, Danville, Ill., and also one to the Park Fire Clay Company, of Pittsburg, Pa.

The report of the receiver for the Pioneer Brick Company, Galesburg, Ill., has been filed. Numerous improvements have been made on the plant, and paving brick are now being turned out at the rate of a million a day.

The Red River Valley Brick Company, Grand Forks, Minn., will erect a large paving brick plant. They have found clay in the vicinity which leads them to believe that they can produce a superior quality of pavers.

East St. Louis, Ill., contemplates purchasing a steam road-roller. A committee composed of aldermen Robert Cunningham, John Kickham, Louis W. Knauss, Charles D. Morrison, George L. Hursey, Charles R. Hissrick and Stephen D. Sexton, visited Springfield, Ohio, about July 15th, to see the O. S. Kelly Company's roller in operation.

The Carson Trench Machine Company, of Boston, has issued a beautifully printed new catalogue of their hoisting and conveying machinery for excavating and refilling trenches. It contains a number of illustrations showing the machinery in operation, and detail drawings show its advantages and economies. The catalogue also contains a number of strong testimonial letters from city officials and contractors.

J. W. Penfield & Son, Willoughby, O., have issued another of their handsome illustrated catalogues, the latest being on the subject of "Penfield Dry Press Brick Machinery," the points of which are fully set forth by illustrations and full explanatory text. In describing the general construction of this machinery, the catalogue says: "The Penfield dry press brick machines are constructed of the best of materials, and are of unusually massive proportions, provision being made throughout for securing a surplus of strength. The shafting throughout is of steel, unusually large in diameter, with long bearings and gearing of pro-

portionate strength. Steel forgings and castings are plentifully employed wherever extra strength or durability is required. The aim has been to combine great strength and efficiency with the highest possible degree of simplicity and the fewest parts. In operation, the machines are light running and work smoothly and evenly, producing the finest grade of plain or ornamental brick."

Mr. T. F. McClure, secretary of the Union Paving Company of Cincinnati, informs us that the statement that a receiver had been appointed for his company on the application of the Middleport Granite Brick Company, of Middleport, Ohio, was erroneous. A suit for the appointment of a receiver was filed, growing out of the litigation between the two companies, but the case has not come to trial, and no receiver has been appointed, and Mr. McClure says there is not likely to be one appointed. The Union Paving Company has filed a suit against the Middleport Granite Brick Company, for $12,000 on account, and $20,000 damages, and has asked for a receiver for that company.

The American Cement Co., of Philadelphia, has published a pamphlet of 114 pages, giving a history of the Portland cement industry in the United States. In addition to reviewing the growth of the industry, it gives specifications used in large engineering enterprises, tests by many experts and much statistical information. It also contains over a hundred halftone illustrations of engineering work in which large quantities of cement have been used. Three of these—the outlet of Niagara tunnel, the East river gas tunnel and cable tunnel of the Metropolitan railroad—are reproduced in this number. A large number of testimonial letters are a feature of the publication, with much of value to persons interested in cement. Copies may be obtained from the American Cement Co., No. 22 South Fifteenth street, Philadelphia.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Front-st., Mobile, Ala., is being paved with chert.

Beaumont-ave., Baltimore, Md., is being macadamized.

Nashville, Tenn., is experimenting with chert for paving purposes.

Street paving has cost Newark, N. J., $1,036,508 during the past year.

A. Saal, Pekin, Ill., is laying 10,000 feet of cement walks at Ottawa, Ill.

Work has been commenced macadamizing Maple-st., Somerville, N. J.

The work of macadamizing Cumberland-st., Portland, Me., has been begun.

Work on the N. Court-st. pavement, Montgomery, Ala., has been commenced.

The Winona construction company has completed its paving contract at Sparta, Wis.

The work of paving River-ave., Allegheny, with Ligonier block has been completed.

The macadamizing of Mt. Pleasant-ave., Short Hills, N. J., is being pushed rapidly.

Saginaw, Mich., has decided to postpone the paving of James-st. with brick till next year

A petition has been presented to have Golden Gate-ave., San Francisco, declared a boulevard.

Dolese & Shepard, Chicago, Ill., are making good progress in their work on the Sheridan road.

The bids for paving Elm-st., Indianapolis, Ind., with asphalt, were rejected. The work will be readvertised.

The old asphalt pavement on Second-ave., Pittsburg, has been torn up and replaced with Ligonier blocks.

The Hastings paving company has completed laying the asphalt block pavement on Pearl-st., Hartford, Conn.

It has been decided to use Ligonier block instead of granite on the Lacock-st. pavement, Allegheny, Pa.

The proposition to bond Wilmington, O., for $7,000, for street improvements, was carried at a special election.

Lowell, Mass., proposes to make a test of the merits of Salem trap rock and Lowell crushed stone on High-st.

The Sicilian paving company will resume work on the Third-st. asphalt pavement, Williamsport, Pa., at once.

All bids for paving sundry streets at Montgomery, Ala., have been rejected. The city engineer will probably do the work.

The work of laying the E. Genessee-st. asphalt pavement, Syracuse, N. Y., has been begun by the Warren-Scharf asphalt paving company.

It has been decided to pave Wabasha-st., St. Paul, Minn., with a strip of asphalt ten feet wide on each side and granite in the center.

San Francisco, Cal., refursed to accept Hayes-st., between Steiner and Fillmore-sts., which was newly paved with asphalt, because of faulty work.

Permission has been given the street railway company, Hartford, Conn., to pave between the rails and four inches outside with asphalt blocks.

Paving on Water-st., Sandusky, O., will be commenced shortly. Coleman & Hallwood, who have the contract, expect to complete the work in sixty days.

The brick pavement laid on Esplanade-ave., New Orleans, La., is giving satisfaction and is leading to a demand for similar material on other streets.

At a meeting of W. Fourth-st. property-owners, Mansfield, O., it was decided to petition the council to pave that street with asphalt instead of brick as ordered.

The cost of the asphalt pavement on Madison Square, Oneida, N. Y., was $2.08 per square yard. The work was done by the village and is cheaper than the lowest bid received.

The town board, Floral Park, L. I., voted an additional $2,000 for the completion of the Middle Neck road improvement, $12,000 having been voted at a previous meeting.

W. F. Williams, city engineer, New Bedford, Mass., at a meeting of the city council, submitted an extended report recommending asphalt as the material to be used in paving Pleasant-st.

Residents along Henry and Morris-sts., Philadelphia, Pa., object to paving these thoroughfares with asphalt. An effort will be made to have the ordinance amended and brick substituted.

It is proposed to pave Main-st., Kansas City, Mo., with an eighteen-foot asphalt center and stone block pavement nine feet wide on each side; thus, when the asphalt is slippery, the grade may be traversed on the stone roadways.

Some impatience has been expressed by business men of Minneapolis, Minn., because of the delay in pushing the paving of Nicollet-ave., which was due to the fact that the asphalt machinery was delayed. The work is now under way and will be completed shortly.

A suit has been filed in Omaha by John Grant to restrain the city from paying Hugh Murphy $6,735.40 for paving materials, which it was agreed by a committee to buy in consideration of Mr. Murphy's not holding the city to contracts for work which they wished to abandon.

The state bureau of highways has made arrangements with railroad companies so that crushed rock can be hauled from the bureau's plant at Folsom to any point within a radius of twenty miles of San Francisco at rates only half as much as those that have been in vogue until now. It is estimated that the proposed free road from Mariposa to Yosemite Valley can

be built for $60,000. It will be open all the year round, while the present roads are impassable in winter on account of snow. Each person going into the valley by the toll road is obliged to pay $1, irrespective of the number of horses. Thus six persons with a two-horse team are charged $6 toll each way. This oppressive tax, received by private persons from the traveling public, will be abolished by the new road.

CONTRACTS AWARDED.

F. O. Blake & Co. will repair the pavemen on Curtis-st., Denver, Col.

Wright & Lindsley secured contract for ten miles of street improvements at Orange, N. J.

The contract for macadamizing streets at Belleville, N. Y., was awarded to Watson & Laing.

Doidge & Co. were awarded the contract for paving King-st., Winnipeg, Manitoba, for $1,160.

J. B. Smith & Co. received the contract for paving Milwaukee-ave., Chicago, Ill., with brick for $42,000.

The contract for paving Seventh-st., Sedalia, Mo., was let to E. G. Church for $1.95 per square yard.

J. K. Hadley, Canton, O., received the contract to pave Wooster pike, Cleveland, O., with brick at $36,274.

The contract for paving S. Anderson and Sixteenth-sts., Elwood, Ind., was awarded to P. T. O'Brien for $3,916.

The contract for macadamizing Hickory-st., Mankato, Minn., was awarded to T. R. Coughlan for $1,383.

William Burger received the contract for macadamizing Spring-st., Boonville, Mo., at $4.40 per square yard.

The Vulcanite paving company has the contract for resurfacing Diamond-st., Philadelphia, Pa., with asphalt.

The contract for paving Ambrose-st., Rochester, N. Y., with brick was awarded to Chambers & Casey for $9,072.40.

The contract for paving Michigan-ave., Lansing, Mich., with brick was awarded to Woodcock & Kineal for $31,000.

The Talbot paving company was awarded the contract to pave Market-st., Logansport, Ind., with brick for $11,802.58.

Fielding & Shepley secured the contract for the improvement of Fairmont-ave., St. Paul, with cedar block, for $3,270.

The contract for paving Main-st., Elkhart, Ind., with brick was awarded to W. W. Hatch at $1.19 per square yard.

James Worswich was awarded the contract for paving Church-st., Visalia, Cal., with asphalt at $2.23 per square yard.

Thomas Mahoney secured the contract for paving Allen and Cherry-sts. and Pater's alley, Jamestown, N. Y., for $21.-476.

Eugene Kirk, C. E., reports that the contract for grading Loveless-ave., Youngstown, O., was awarded to M. Horan.

The contract for the improvement of Hanley road, near Cincinnati, O., was awarded to Reubel Bros. at their bid of $16,218.97.

The Construction and Paving company was awarded the contract for paving Avenue road, Toronto, Can., with asphalt for $14,160.

The Capitol paving and construction company was awarded the contract for resurfacing Coburn-st., Indianapolis, Ind., with brick.

The contract to macadamize the northern portion of Webster-st., San Francisco, Cal., was awarded to the Piedmont paving company.

The contract for paving Main-st., Los Angeles, Cal., with asphalt was awarded to the Union paving company at $11.80 per lineal foot.

The Western paving and supply company secured the contract for paving East-st., Indianapolis, with asphalt at $4.57 per lineal foot.

The Indiana Bermudez asphalt paving company was awarded the contract for paving St. Clair-st., Indianapolis, with asphalt at $4.75 a foot.

Bellew & Merritt, Tuxahoe, N. Y., have been awarded contract for laying telford-macadam pavement on McLean-ave., Yonkers, N. Y., for $3,349.69.

H. A. Collar, city engineer, Grand Rapids, Mich., reports that the contract for paving Pearl-st. with brick has been awarded to James McDermott at $1,750.

Harvey Linton, city engineer, Altoona, Pa., reports that the contract for paving Fourteenth-st. and Tenth alley was awarded to the Barber asphalt paving company at $2.58 per square yard.

H. Ward, C. E., reports that the Warren-Scharf asphalt paving company received the contract for paving Washington-st., between Court and Hawley-sts., Binghampton, N. Y., at $2.69 per square yard.

The Barber asphalt paving company secured the contract for paving Eighth-st., Kansas City, Mo., for $2.65 a yard. The contract for paving Fourteenth-st. with brick was awarded to J. J. McGovern for $1.24 a yard.

William H. Sherman was awarded contracts at Camden, N. J., as follows: Belgian blocks; Ninth-st., at $1.60 per square yard; Sixth-st., at $1.58; Eighth-st., at $1.60. Ward Brothers received the contract for construction sewers in Birch, Royden, Henry, Liberty and Washington-sts. and Jefferson-ave.

Fielding & Shipley were awarded the contract for paving St. Peter-st., from Tenth-st. to College-ave., St. Paul, Minn., with cedar block for $1,338, and Hennessey & Cox got the contract for paving St. Peter-st., from Third to Tenth-st., with asphalt for $20,240. The contract for paving Sibley-st. with brick was adwarded to Frank McClellan at $5,050.

Paving contracts were awarded at Newark, N. J., as follows: Orange-st., granite blocks, to David Harper for $63,018; Eighth-ave., granite and trap rock, to Thomas A. O'Connor, for $26,342; Eighteenth-ave., trap rock, to John F. Shanley for $21,748; Summer-ave., asphalt, to New Jersey asphalt company for $60,342; Sherman-ave., asphalt, to Barber asphalt paving company for $27,438; Somerset-st., asphalt, to Barber asphalt paving company for $24,748.

The contract for paving N. Meridian-st., from New York to Vermont-sts., Indianapolis, Ind., with asphalt, was awarded to the Western paving and supply com-

pany at $7.85 per lineal foot on each side. Fulmer & Seibert were awarded the contract to pave Meridian-st., from Vermont to St. Clair-sts., with cedar block at $7.73 per lineal foot, and Browder & Shover secured the contract for paving Meridian-st., from St. Clair to Seventh-st., with cedar block at $5.60 per lineal foot.

CONTEMPLATED WORK.

St. Paul, Minn., will pave Fifth-st. with asphalt.

W. Main-st., Middletown, N. Y., will be improved.

Fifth-st., Logansport, Ind., will be paved with brick.

Main-st, Burlington, Ia., will be paved with brick.

Arnold-st., New Bedford, Mass., is to be macadamized.

Gifford-st., New Bedford, Mass., will be macadamized.

Grand-ave., Hackensack, N. J., will be macadamized.

It is contemplated to improve Main-st., Memphis, Tenn.

Columbia-st., Indianapolis, Ind., will be paved with brick.

Child-st., Rochester, N. Y., will be paved with block asphalt.

Lawrence, Mass., contemplates macadamizing S. Union-st.

Pacific-ave., Tacoma, Wash., will be paved with fir blocks.

Clinton-st., Defiance, O., has been ordered paved with brick.

East Willow Grove-ave., Germantown, Pa., will be macadamized.

Lancaster, O., contemplates paving Winding-st. with fire brick.

An ordinance has been passed to pave Prairie-st., Bloomington, Ill.

Greene county, Indiana, contemplates macadamizing several roads.

Glens Falls, N. Y., contemplates improving Bay-st. with aspnalt.

Arsenal and Arcade-sts., Watertown, N. Y., will be paved with asphalt.

An ordinance has been passed to pave Coliseum-st., New Orleans, La.

Michigan-st., Toledo, O., will be paved with brick, medina stone or asphalt.

A petition to pave Court place, Denver, with asphalt has been presented.

Rockland, Fifth and Rivet-sts., New Bedford, Mass., will be macadamized.

A resolution has been passed ordering the paving of N. Depot-st., Toledo, O.

The county road between Salina and Monterey, Cal., is to be macadamized.

Wick-ave., Youngstown, O., will be macadamized to the Trumbull county line.

Union-ave., Washington-ave. and Sixteenth-st., Altoona, Pa., will be paved.

Allegheny, Pa., is contemplating constructing a macadam boulevard six miles long.

A resolution has been adopted for paving Franklin place, Cleveland, O., with brick.

An ordinance has been passed ordering Adams-st., Kansas City, Mo., paved with brick.

A petition has been presented to pave E. Washington-st., Indianapolis with asphalt.

Kentucky-ave., Indianapolis, will be paved with brick from end of asphalt to Merrill-st.

A resolution was passed ordering Olive and East-sts., Bloomington, Ill., paved with brick.

Property-owners on Ninth-st., Kansas City, Mo., have petitioned to have the street paved.

An asphalt bicycle track, to be built at Bay Shore park, is being discussed at Peshtigo, Wis.

Elizabeth, N. J., contemplates paving Stiles and Sayres-sts. with trap rock and telford-macadam.

South Broad, Abercorn, Habersham and New Houston-sts., Savannah, Ga., will be paved with chert.

An ordinance has been passed ordering Third-st., Portland, Ore., to be paved with Pitch lake asphalt.

Resolution for the improvement of Washington-st., Wabash, Ind., was passed by the city council.

The board of freeholders, Hasbrouck Heights, N. J., will be petitioned to macadamize Lodi-ave.

S. H. Finley, city engineer, reports that Santa Ana, Cal., will pave two blocks of Fourth-st. with asphalt.

An ordinance has been passed to pave Ferry-st., Buffalo, N. Y., with asphalt over the present stone pavement.

It has been decided to pave State-st., Hartford, Conn., with block asphalt and Main-st., with sheet asphalt.

An effort is being made to have S. Twelfth-st., which connects Armourdale and Argentine, Kan., improved.

Newark, N. J., contemplates paving Congress, Prospect and S. Tenth-sts. and Belmont-ave. with vitrified brick.

A resolution has been adopted to pave Kirby-ave., Detroit, Mich., with asphalt. Bids will be asked in a few days.

Albany, N. Y., contemplates paving Swan and Phillips-sts. with brick. The ordinances will be acted on Aug. 5.

Residents of Saratoga-ave., Brooklyn, N. Y., have petitioned the common council for asphalt on that thoroughfare.

Resolutions have been passed ordering Chancery, Mead and W. Hanover-sts., Trenton, N. J., to be paved with brick.

George B. Slade, C. E., advises us that Glens Falls, N. Y., contemplates putting in a section of brick or asphalt pavement.

New Haven, Conn., will improve New-st. Petitions have also been presented to pave Orange and Chapel-sts. with asphalt.

Ordinances have been passed for the improvement of Wright-st., Newark, N. J., with asphalt and Washington-st. with granite.

State-st., and American and Central-rows, Hartford, Conn., will be paved with block asphalt. Main-st. will be paved with sheet asphalt.

Harvey Linton, city engineer, Altoona, Pa., reports that the petition to pave Tenth-ave. with sheet asphalt, was favorably reported.

The following paving is contemplated at Newark, N. J.: South, Tenth and Johnson-sts., with brick; Roseville-ave., Bruce and Lafayette-sts., with sheet asphalt; Belmont-ave., with granite blocks, and Fifteenth-st. with trap rock block.

Pavements were ordered laid within thirty days on Lincoln, Reading and Bessemer-sts. and Juneberry and Mulberry alleys, Steelton, Pa.

Ordinances have been passed to macadamize a number of streets in Park road addition, La Grange, Ill., at an estimated cost of $21,500.

Resolutions have been adopted ordering Cherry and Ann-sts. and Hayden and Parsons-aves., Columbus, O., paved with either brick or asphalt.

Ordinances have been passed ordering the grading, curbing and paving of Winthrop and Fillmore-sts. and Costume and Edward alleys, Pittsburg, Pa.

Resolutions have been passed at Cinnati, O., for paving Baker-st. and Crippen alley with asphalt, and for paving Pitts-st and Voss alley with brick.

The board of park commissioners, New York City, have been petitioned to pave Fifth-ave., between Nintieth and One Hundred and Tenth-st., with asphalt.

Ordinances have been approved to pave Geyer, Easton, Illinois, Evans and Goodeaves., Union boulevard and Magazine, Hickory and Wyoming-sts,. St. Louis, Mo.

Brooklyn, N. Y., contemplates paving Putnam-ave., Russell place, Sixteenth-st. and Willoughby-ave. with asphalt; also repaving Clifton place, Clark, Walton and Essex-sts.

Bids for the following paving will be asked soon at Camden, N. J.: State and Washington-sts., Belgian block; Sycamore-st., Friends-ave. and Washington-st. with assorted rubble.

Resolutions have been adopted to improve streets at Kansas City, Mo., as follows: Asphalt, Tracy-ave. and Central-st.; macadam, Flora-ave. and Southwest boulevard; brick, Twentieth and Summit-sts., alley between Sixth and Seventh-sts. and alley between St. Louis and Union-aves.

The following streets have been ordered improved at Brooklyn, N. Y.: Douglass-st., Hamburg, East and New York-aves. with Belgian blocks; Decatur, Keap, Dean, Quincy, Hancock, State, N. Sixth, Berry and Macon-sts., and Park place, Prospect place, St. Mark's-ave. and Grand-ave. will be paved with asphalt.

CONTRACTS TO BE LET.

Middletown, N. Y., invites bids until Aug. 5 for paving E. Main-st. with brick.

Eugene Whiting, city clerk, Canton, Ill., invites bids until Aug. 9 for paving streets with brick.

Bids will be received by the city clerk, Belleville, Ill., until Aug. 3 for paving W. Main-st.

John A. Hahn will receive bids until Aug. 1 for paving sundry streets at Grossdale, Ill.

Bids will be received until Aug. 17 for macadamizing Reilly-st., Norwood, O., by W. E. Wichgar.

Sealed proposals will be received until Aug. 5 for grading and curbing Clay-ave., Jeanette, Pa. Check, $200.

The town board, Irvington, Ind., will receive bids for constructing cement sidewalks on the west side of Central-ave. and both sides of Washington-st. until Aug. 6.

Bids will be received until Aug. 3, by F. M. Remy, city clerk, Mansfield, O., for improving W. Fourth-st.

Sealed bids will be received until Aug. 6 by W. A. Blicke, city clerk, Bucyrus, O., for improving West alley.

The board of public works, Milwaukee, Wis., will receive bids until Aug 1 for paving Mason-st. with brick.

Ed Wright, Des Moines, Ia., will receive bids until Aug. 3 for vitrified paving brick and cement curbing.

J. H. Winder, Richmond, Ind., will receive bids until Aug. 16 for furnishing stone curbing and brick gutters.

Sealed proposals will be received at Cleveland, O., till Aug. 8 for paving Emmett-st. with brick. Bond, $500.

Bids will be received by Thomas Cassellman, city clerk, Alliance, O., for the improvement of Ash-st. until Aug. 3.

Sealed proposals will be received until Aug. 3, at Des Moines, Ia., for paving Nineteenth-st. with brick and with asphalt.

Sealed proposals are invited until Aug. 12 for paving Williams-st., Michigan City, Ind., with brick. Certified check for $200 required.

Proposals will be received by Frank Deitrick, city clerk, Wilkesbarre, Pa., for repaving Northampton-st. with asphalt until Aug. 3.

Bids will be received by the board of public works, Indianapolis, until Aug. 3 for paving Central-ave with cedar blocks. Check for $300 required.

T. J. Cooney, city recorder, Dubuque, Ia., will receive bids until Aug. 3, for macadamizing and curbing sundry streets. Bond for $200 required.

Sealed proposals will be received until Aug. 8 by the board of public works, Indianapolis, for paving Tenth-st. with asphalt. Check for $100 required.

Sealed bids will be received by A. P. Butterfield, Cincinnati, O., until Aug. 8 for paving Spring Grove-ave., from Dodsworth-ave. to Dane-st., with brick.

W. J. Butter, clerk, Pontiac, Ill., will receive bids until Aug. 15 for paving Main, Mill, Madison and Washington-sts. with brick. Certified check for $300.

Bids will be received by the board of public improvements, St. Louis, Mo., until Aug. 11 for repairing asphalt pavements on Pine, Ninth and Locust-sts.

M. O. Burns, city clerk, Hamilton, O., will receive bids until Aug. 20 for paving Main-st. with brick. Certified check for 5 per cent. of estimated cost required.

Sealed proposals will be received at Albany, N. Y., until Aug. 5 to pave Third-ave. and Dean-st. with dimension granite blocks, and to pave Park-st. with brick.

Sealed proposals will be received at Dubuque, Ia., to macadamize Leibnitz, Woodworth, Rush, Paul and Fengler-sts. and Fifth, Schiller and Atlantic-aves. until Aug. 3.

Sealed proposals will be received by the board of administration, Cincinnati, O., until Aug. 7 for paving Martin-st. with brick and constructing necessary drains, culverts and retaining walls.

Sealed proposals will be received until Aug. 2 by A. T. White, Brooklyn, N. Y., for paving S. Ninth-st. with asphalt; deposit $410 required. Also for repaving Jefferson-ave. with asphalt; deposit, $1,130.

Bids will be received until Aug. 5 for the construction of the east and west approaches to Coe road bridge over Alum creek by William H. Halliday, county auditor, Columbus, O. Cash deposit of $100 required.

Sealed proposals will be received by Charles E. McLean, chairman of street committee, Mobile, Ala., until Aug 1., for paving Commerce-st., from south side of Government-st. to the north side of St. Louis-st., with granite blocks.

Sealed proposals will be received until Aug. 2 by Alfred T. White, commissioner, Brooklyn, N. Y., for repaving the following streets with asphalt: Bainbridge-st., amount of deposit required, $375; McDonough-st., amount of deposit required, $900; Madison-st., amount of deposit required, $410; Macon-st., amount of deposit required, $410; New York-ave., deposit of $350 required.

SEWERS.

The new sewer system at Oconto, Wis., has been completed.

The work on the sewer extension, Belfast, Me., will be begun shortly.

Work on the sewerage system at Newark, N. J., will be pushed rapidly.

It will require 6,000,000 bricks to complete the Carthage pike sewer at Cincinnati, O.

Eugene Kirk, C. E., reports that the Grace-st. sewer, Youngstown, O., has been completed.

The irrigation ditch near Ontario, Ore., which is to be nearly twelve miles long, is nearly completed.

The Woods run sewer, Allegheny, Pa., has been completed. It is supposed to be one of the largest sewers in existence.

Mayor J. W. P. Kingsley, Rome, N. Y., has engaged Civil Engineer W. B. Landreth, Cortland, N. Y., to look over the plans for a new sewer system.

The contract for the construction of the Easby's Point sewer, Washington, D. C., has been extended to Oct. 1, 1895. It was to have been completed July 1.

The contract for furnishing Minneapolis, Minn., with cement during the coming year was awarded to the Northwestern cement company at $2.60 per barrel.

Consulting Engineer S. M. Gray, Providence, R. I., is at San Antonio, Tex., to inspect the brick used on the sewerage system now in course of construction.

The contract for the sewerage system at Dallas, Tex., has been transferred to Wilding, Marshall, Backus & Hines of Indianapolis. They have given an acceptable bond of $100,000 to carry out the contract.

M. J. Blanding, city engineer, Galesburg, Ill., reports that 100 feet of forty-eight-inch double ring sewer laid on a reverse curve with a radius of thirty-five feet, at a cost of $3.50 per lineal foot, has been completed.

CONTEMPLATED WORK.

A new sewer will be built at Quincy, Mass.

A sewerage system is contemplated at Boulder, Col.

A sewer is contemplated in Lovejoy-st., Portland, Ore.

A sewer is contemplated in Stiles-st., Elizabeth, N. J.

A sewer will be constructed in Whitney-ave., Toledo, O.

Jamaica, N. Y., contemplates a new sewerage system.

A sewer in Harmon-st., Waverly, Ia., has been ordered.

Youngstown, O., is contemplating a new sewerage system.

Portsmouth, O., is considering a new sewerage system.

A sewer wil be constructed in Macadam-st., Portland, Ore.

A trunk sewer is being discussed at Binghamton, N. Y.

Madison, Wis., will vote on the question of a sewerage system.

The sewer in Wickham-ave., Middletown, N. Y., will be extended.

Albert Lea, Minn., will secure plans for a new sewerage system.

A sewer wil be constructed in Weimer-st., Buffalo, N. Y., at once.

A sewer has been ordered to be built in the East Side, Oakland, Cal.

Sewers will be constructed in E. Third and Crosby-sts., Portland, Ore.

The question of a sewerage system is being discussed at Sycamore, Ill.

The city council, Chillicothe, O., is considering a new sewerage system.

Sewers have been ordered in S. Third and Olive-sts., Stillwater, Minn.

Plans for a sewerage system at West Norwood, O., have been adopted.

The extension of the Murray-st. sewer, Kingston, N. Y., has been ordered.

Sewers have been petitioned for Liberty and Front-sts., Camden, N. J.

An ordinance has been passed ordering a sewer in Wick-st., Pittsburg, Pa.

Main and lateral sewers are contemplated in Indiana-ave., Indianapolis.

Sewers will be constructed in Union, McCurdy and Myrtle-sts., Cleveland, O.

Lateral sewers will be constructed in a number of streets in Lansingburgh, N. Y.

Paterson, N. J., contemplates constructing sewers in N. Sixth and E. Thirtieth-sts.

A sewer down the valley of Willow creek, Mason City, Ia., will be built at once.

Livingston, N. Y., is to have a complete sewerage system at a cost of about $12,000.

Belfast, Me., will build sewers in High and Bridge-sts., a total length of about 1,400 feet.

Bids will soon be asked for the construction of a general belt sewer at Terre Haute, Ind.

Sewers have been ordered in Spring, Maple and Myrtle-aves. and in Eagle-st., Troy, N. Y.

An ordinance has been passed for the construction of a sewer in Hayes-st., Chester, Pa.

A fifteen-inch pipe sewer has been ordered in Second and Washington-sts., Waterloo, Ia.

Resolutions have been passed to construct sewers in Luverne and Bradwell-sts., Cleveland, O.

The feasibility of constructing two ten-foot intercepting sewers is being discussed at Chicago, Ill.

The question of a new sewer outlet for the Central-ave. sewer is being discussed at West Duluth, Minn.

It is estimated that the projected sewer and roadway through the Bronx valley, N. Y., will cost $15,000,000.

The city council of Waterloo, Ia., has ordered sewers to be built in Randolph, Second and Washington-sts.

An ordinance has been passed for constructing a district sewer in Euclid-ave., St. Louis, Mo., to cost $187,000.

Sewers have been recommended to be constructed in N. Water-st. and Kinnickinnic-ave., Milwaukee, Wis.

Bids for sewers have been ordered advertised for in Erie, Point, Liberty, Master and Fourth-sts. at Camden, N. J.

Plans for a surface drainage sewer to cost $150,000 have been prepared by Commissioner A. T. White, Brooklyn, N. Y.

Sewers will be constructed at Trenton, N. J., in Haggerty alley, Greenwood-ave., Hewitt and Rusling-sts. and Chestnut-ave.

Ordinances have been passed for sewers in Lincoln, Vine, S. Burritt, Murray, Liberty and Curtis-sts., New Britain, Conn.

The Iowa engineering and construction company, Clinton, Ia., is making plans for a complete sewerage system at Marshfield, Wis.

Sewers have been ordered in Virginia and Brightwood-aves. and in Seventh, D, Kenyon, I and Lydecker-sts. in Washington, D. C.

Ordinances have been passed for the construction of sewers in Bloomer, Gibbon and Chestnut-sts. and Glosser alley, Pittsburg, Pa.

Sewers will be constructed in Lang, S. Thirteenth, S. Eleventh, S. Ninth-sts. and Clifton, Summer and Johnson-aves., Brooklyn, N. Y.

An ordinance was passed ordering the construction of the Amsterdam branch of Willow run sewer, Covington, Ky. Estimated cost, $5,090.

Ordinances have been passed at Erie, Pa., for constructing sewers in Thirteenth, Fourteenth, Fifteenth, Second, Myrtle and Holland-sts.

Harvey Linton, city engineer, Altoona, Pa., reports that ordinances for constructing sewers in Lexington, Third and Fourth-aves. were reported favorably.

Resolutions have been adopted for constructing sewers in the following streets at Cleveland, O.: Hamilton, Eastdale, Herald, Yeakel, Mather, Montrose and in Watkins and Pennsylvania-aves.

Harvey Linton, city engineer, Altoona, Pa., reports that ordinances for pipe sewers have been approved as follows: W. Chestnut-st., Pine-st., Third-ave. and Fifth alley; all with necessary Y branches, manholes, etc.

Ordinances have been passed at Pittsburg, Pa., ordering 15-inch pipe sewers to be constructed in Cabinet, Logan, Overhill, Inwood, Celadine, Coral, Muriel, Adelaide, Beelen and Holmes-sts. and Friendship-ave. and Florida, Boone, Poplar and Carpenters alleys.

CONTRACTS TO BE LET.

F. R. C. Perrin, Crafton, Pa., wants bids until Aug., 5 for constructing sewers.

John A. Hahn, Grossdale, Ill., will receive bids for constructing sewers until Aug. 1.

Bids will be received until Aug. 3 at Ithaca, N. Y., for constructing four miles of lateral sewers.

Brazil, Ind., will receive sealed bids until Aug. 20 for constructing 1,500 feet of vitrified pipe sewer. Bond, $500.

W. M. Dame, city clerk, Titusville, Pa., invites bids for constructing sewer in Drake-st. until Aug. 5. Bond, $200.

Bids will be received until Aug. 6 by J. W. Tyndall, city engineer, Decatur, Ind., for constructing a tile sewer.

Bids will be received until Aug. 6 for repairing and reconstructing brick sewer in Tenth-st., Cairo, Ill. Bond, $500.

Bids will be received by the city clerk, Hammond, Ind., for building a sewer in N. Calumet-ave. Certified check for $500 required.

Elias G. Pease, city clerk, Mt. Vernon, N. Y., will receive bids until Aug. 6 for constructing a sewer in Monroe-st. Two sureties required.

Proposals will be received by S. L. Strasser, box 42, New Kensington, Pa., for constructing pipe sewer in Eleventh-st. until Aug. 1.

Sealed proposals will be received for constructing sewer and water connections until Aug. 1 by the board of public works, Milwaukee, Wis.

Sealed proposals will be received until Aug. 13 for the construction of the White river intercepter sewer by the board of public works, Indianapolis.

Sealed proposals will be received by the committee on sewers, Orange, N. J., for the construction of 2,600 feet of brick and 28,825 feet of vitrified pipe sewers until Aug. 5. Check for $2,500 required.

Sealed proposals will be received by H. J. Nyhus, clerk, Hillsboro, N. D., for constructing 3,152 feet of pipe sewers; 136 six-inch Ys, ten manholes and ten catch basins. Bond for 50 per cent. of bid required.

Bids are invited at Wahpeton, N. D., until Aug. 12 for building 670 feet of fifteen-inch pipe sewer, 748 feet of eighteen-inch and 1,268 feet of twenty-inch, with eight manholes and fourteen catch basins.

Bids will be received until Aug. 3 by the board of public works, Indianapolis, for constructing sewers in the following streets; Charles-st., Palmer-st., first alley east of Broadway, first alley east of Meridian, and in first alley east of College-ave. Bids will also be received until Aug. 8 for constructing a sewer in Alabama-st. Check for $100 on each bid required.

CONTRACTS AWARDED.

The contract for the Brunswick, Me., sewer system was awarded to Hacker & Cobb for $1,900.

The contract for furnishing vitrified pipe and constructing sewers in Clark and Frank-sts and Maryland-ave., Syracuse, N. Y., was awarded to Martin Lavelle for $1,931.50.

The contract for a culvert on E. Morgan-st., Boonville, Mo., was let to F. Stretz for $365.

N. F. Reichert & Co., secured the contract for constructing sewers at Kenosha, Wis., for $6,000.

Hamilton & Knepper, Sioux City, Ia., secured the contract for sewers in Grinnell, Ia., for $28,111.28.

J. P. Thon, Owatonna, Minn., secured the contract for putting in the Spring lake drain for $1,514.80.

H. J. Riden was awarded the contract for constructing sewers in Elm and Madison-sts., Waverly, Ia.

The contract for sewer work at Rochester, Minn., was awarded to McLean & Gleason for $4,325.

Hurd, Bowen & McGill were awarded the contract for constructing a sewer in Clark-st., Mankato, Minn.

Rinker & Hoff, Minneapolis, Minn., secured the contract for a new sewer to cost $10,300 at Fargo, N. D.

The contract for constructing a brick trunk sewer in Meridian-st., Buffalo, N. Y., was awarded to Ryan & Delany.

The contract for pipe sewers in Collier, Clinton and Goethe-sts., Binghamton, N. Y., was let to Frank Dennison for $1,505.25.

The contract for the Seventh ward sewer system, Rock Island, Ill., was awarded to the Davis company for $4,666.96.

Burns & Banks, Niagara Falls, N. Y., secured the contract for constructing an outfall sewer at Ithaca, N. Y., for $19,303.25.

The contract for constructing sewers in Renner, Byron and Vernon-sts., Cincinnati, O., was awarded to Frank Nolte at $2,087.34.

Sackett Bros., Springfield, Mass., secured the contract for constructing a sewer in Green-st. district, Deerfield, Mass., for $2,250.

The contract for constructing a 5 by 4 sewer in Chestnut and Linn-sts., Muscatine, Ia., was awarded to E. Baker at $3.52½ per lineal foot.

Contracts for sewers were awarded as follows at Lancaster, Pa.: Middle-st., I. Pfeffer, $725; Walnut and Charlotte-sts., Schwartz & Aucamp, $600.

Wilmington, Del., awarded the contracts for constructing sewers in Lovering, Hancock, Beech, Van Buren, Maple, Buena Vista and Mills-sts. to John Jacoby.

H. Ward, C. E., Binghamton, N. Y., informs us that contracts for two pipe sewers have been awarded, one to J. C. Smith at $1,649 and the other to Frank Dennison at $779.90.

Harvey Linton, city engineer, Altoona, Pa., reports that the contract for constructing sewers in Third-ave., Fifth alley, Pine and Nineteenth-sts. were awarded to Isaac Bender.

H. A. Collar, city engineer, Grand Rapids, Mich., reports that contracts for sewers have been let as follows: Butterworth-ave., 746 feet, nine-inch pipe, at $588; Worden-st., 1,221 feet, nine and twelve-inch pipe, at $615.68; N. Pine-st., 300 feet, nine-inch pipe, at $163; N. Lane-ave., 328 feet, nine-inch pipe, at $231.

Mansfield & Allen secured the contract for laying a main sewer in the alley north of Buchanan-st., Indianapolis, at $1.85 per lineal foot. Fulmer & Seibert were awarded the contract for a local sewer in Noble-st. at $1.82 per lineal foot.

The following contracts were awarded for sewers at Alton, Ill.: Langdon-st., to A. J. Degenhart for $3,793.84; Fourth-st., to A. J. Degenhart for $1,043.49; Third-st., to Wolf & Maupin for $623.60; Second-st., brick sewer, to David Ryan for $3.90 per foot.

Contracts for constructing sewers, Pittsburg, Pa., were awarded as follows: Addison, Bidwell, Crawford, Colwell, Dearborn, Evaline, Furnace and Miller-sts., Craft and Lang-aves. and Violet alley to Evan Jones; Butler and Wells-sts., Jordan alley and Liberty-ave. to W. J. Dunn; Washington-ave. and Independence-st., to Sloane, McIlwain & Ott Bros.; Merriman's alley, to James H. McQuaide.

Contracts for sewers at Milwaukee, Wis., were let as follows: Williams-st., to Herman Habensee at 84 cents per lineal foot; Becker-st., to James Millane at $2 a foot and 1,262 feet of pipe sewer at 93 cents a foot; Alexander-ave. and Twelfth-st., to Matt Chybouski at 81 cents a foot; Fratney-st., to Henry Vogt at 93 cents; Rogers-st. and Fifteenth-ave., to George E. Zimmerman at 76 cents; Chambers, Wall, Burleigh and Second-sts., to Daniel O'Driscoll at $2.14 per lineal foot.

WATER-WORKS.

Odell, Ill., will spend $8,000 on water works.

Center Harbor, N. H., is to have new water works.

Lorain, O., voted $125,000 for water works improvements.

The water works system at Cumberland, Wis., has been completed.

The new intake tunnel at Milwaukee, Wis., has been completed.

Battle Creek, Mich., voted to bond itself for $30,000 for water works.

Milwaukee, Wis., contemplates extending its water mains to Wauwatosa.

Bradford, Mass., will purchase the town water supply of the owners for $80,000.

Hutchison, Kas., has given notice that it will purchase the water works system.

Niles, Mich., has accepted the new water works system which was recently completed.

A company has been incorporated at Virginia, Ill., to put in a water works system.

A site has been selected for water works plant at Peru, Ill., and work will proceed at once.

Franchise has been granted for the erection of a $75,000 water works plant at Effingham, Ill.

The proposition for new water works system was defeated at an election at Independence, Kas.

At a special election at Ephrata, Pa., it was decided to borrow $30,000 to purchase water works.

It has been decided to extend the north shore inlet tunnel at Chicago, Ill., a mile farther into the lake.

The proposition to purchase water works plant was defeated at Mountain Iron, Minn.

The Commercial club, Omaha, Neb., passed resolutions in favor of purchasing the water works plant.

Plans for water works system have been prepared for Naples, N. Y., by Witmer & Voorhis, Buffalo, N. Y.

The village of Hibbing, Minn., purchased the water works plant for $11,400 and contemplates sundry improvements.

The new water filter at Milford, Mass., having a capacity of 500,000 gallons a day, is giving entire satisfaction.

Cleveland, O., contemplates extending the water tunnel two miles farther into the lake at a cost of about $900,000.

Chicago, Ill., contemplates putting in a new water works plant at Ashland and North-aves. to supply the West Side.

Greathouse, Taylor & Burr, Beeville, Tex., secured the contract for constructing new water works system at Goliad, Tex.

Stewartsville, Minn., awarded the contract for new water works system to Fairbanks, Morse & Co., Chicago, Ill., for $4,929.

Four water companies, to furnish rates to the boroughs of Sheridan, Esplen, Elliott and McKees Rocks, Pa., were incorporated.

Boston's water supply amounts to 61,500,000 gallons per day and the daily consumption at the present time is estimated at 57,000,000 gallons.

S. H. Finley, city engineer, Santa Ana, Cal., advises us that another artesian well to supply the public water system has been sunk. It is the fourth bored for that purpose.

The water supply of London, Eng., averaged 231,000,000 gallons daily during the month of May as compared with 196,000,000 during the same month last year.

The village trustees, Hempstead, N. Y., refused to buy the water works plant of the Hempstead water works company for $30,000 and will probably proceed to construct a plant of its own.

CONTRACTS AWARDED.

L. J. Richardson & Co., Cortland N. J., secured the contract for constructing complete water works system at Rockville Center, N. Y., for $25,600.

W. H. Bryan, C. E., advises us that the city of Union, Mo., opened bids for a water works plant, but it was decided to make certain improvements which will necessitate deferring further action. It is expected that the matter will be taken up and contracts let in January next.

E. J. Hanlon was awarded the contract for extension of water mains at Sioux City, Ia., for $16,246.70.

The contract for constructing a water works system at Plainview, Mich., was awarded to Fairbanks, Morse & Co. at their bid of $11,800.

Fairbanks, Morse & Co., Chicago, Ill., secured the contract for putting in a water works system at Stewartsville, Minn., for $4,929.

The contract for constructing a water works system at Elphoen, Wis., was awarded to Wells, Reichart & Co., Appleton, Wis., for $21,000.

The contract for constructing water works at Monticello, N. Y., was awarded to the Wild engineering company, New York City, for $18,815.

CONTEMPLATED WORK.

Norwalk, O., will vote on water works question Aug. 13.

Horton, Mich., contemplates a new water works system.

Plans and specifications have been prepared for a new system of water works at Coffeyville, Kas., to cost $50,000.

The construction of water works systems is contempleted at the following places: Marlette, Mich., North Chillicothe, Ill.

Water works have been favorably voted on at the following places: Indianola, Ia., Helena, Mont., Jasper, Ind., Williamsville, N. Y., Duquensne, Pa., Belmont, Wis., Deerfield, Wis., Lancaster, Wis., St. Mary's, O., Elizabethtown, Ky., Oelwen, Ia., Lawrenceville, Ill.

CONTRACTS TO BE LET.

The city council, Butte, Mont., invites bids until Sept. 18 for supplying the city with water.

H. L. Leland, recorder, Schaller, Ia., will receive bids for constructing water works until Aug. 5.

B. H. Garfield, Shawano, Wis., will receive bids until Aug. 1 for constructing a water works system.

Bids will be received by R. F. Taylor, Morristown, N. J., until Aug. 5, for constructing a water works system.

D. A. McDonald Reeve, Alexander, Ont., will receive bids until Aug. 6 for construction of a water works system.

Sealed proposals will be received until Aug. 1 by the board of water works trustees, Logan, O., for constructing a water works system.

Sealed proposals will be received until Aug. 20 by C. W. Cobb, city clerk, Grand Junction, Col., for constructing water works system.

H. W. Latimer, city clerk, Canton, Miss., will receive bids until Sept. 2 for constructing a water works and an electric light plant.

Sealed proposals will be receievd by F. W. Force, recorder, Windom, Minn., until Aug. 9 or the construction of water works and electric light systems.

Sealed bids will be received until Aug. 8 to construct a water works system by Frank M. Molineux, treasurer, Middleville, N. Y. Certified check for $500 required.

BRIDGES.

Three new bridges will be erected near Jacksonville, Ill.

The Weller-ave. bridge, Laporte, Ind., has been condemned.

Jefferson, Wis., voted $2,000 for a new bridge across Rock river.

Plans for the Perry-st. bridge, Toledo, O., have been approved.

A new bridge across Flint river is contemplated at Rogersville, Ia.

A new bridge will be built across Rector creek, near Walpole, Ill.

Several new iron bridges are being constructed in Lake Forest park, Chicago, Ill.

A new steel bridge is contemplated at Oil City, Pa., to cost $50,000.

The new bridge between Glenwood and Hays, Pa., has been completed.

A bridge across the Big Sioux river is being agitated at Elk Point, S. D.

A new bridge will be built across Flint river, near Rogersville, Mich., soon.

A foot-bridge will be constructed across the Mississippi river at Dyersville, Ia.

The new Columbus street bridge, Cleveland, O., has been opened for traffic.

A steel bridge, to cost $4,000, will be built across Holland creek, Girard, Ala.

Eleven new bridges will be built in Audrian county, Missouri, this summer.

A bridge will be constructed across railroad tracks at Ryan-st., Chillicothe, Mo.

A bridge to cost $5,000 will be built across the Menominee river at Marinette, Wis.

Ryan & Brown will replank and repave the Fourth-ave. bridge, Janesville, Wis.

A bridge will be built over Six Mile creek, near Specht's Hill, Seymour, Ind., soon.

Bids for repairing the Mississippi-st bridge, St. Paul, Minn., will be received until Aug. 1.

Proposals will be received until Aug. 1 for constructing the Como-ave. bridge, St. Paul, Minn.

Bids are invited at Frankfort, Ind., for constructing a bright across Sugar creek on the Michigan road.

The state bridge at Carthage, N. Y., has been condemned. Plans are now being prepared for rebuilding it.

N. M. Stark & Co. secured the contract for erecting a bridge over Lime creek, Mason City, Ia., for $1,260.

The Huron-st. bridge, Milwaukee, Wis., has been declared dangerous and a new one should be built at once.

The bridge connecting Louisville, Ky., and Jeffersonville has been completed. The total cost was $1,275,000.

Toronto, Canada, will receive bids for constructing a bridge over the Etobicoke river at Craigs' until Aug. 6.

Sealed bids will be received at McPherson, Kas., until Aug. 6, for repairing three bridges in McPherson county.

The contract for the town of Maine, Minn., bridge was secured by the Milwaukee bridge company for $1,200.

The H. Schultz bridge company was awarded the contract for constructing a bridge at Dow City, Ia., at $1,352.

The board of public works, Nashville, Tenn., will ask for bids soon for constructing a new bridge over Cedar-st.

The contract for the West Main-st. bridge, Belleville, Ill., awarded to A. Geisel & Co., St. Louis, Mo., for $10.500.

J. F. Thompson, county clerk, Parson, Kas., will receive sealed bids until Aug. 5 for constructing a bridge across Negro run.

The Owego bridge company was awarded the contract for the erection of an iron bridge at Warrensburg, N. Y., for $5,000.

J. C. Money, St. Helena, Mont., was awarded the contract for building a bridge across Napa river, at Napa, Cal., for $1,840.

Bids will be received until Sept. 2 by Paul Dekker, county auditor, Olivet, S. D., for constructing an iron bridge across Dry creek.

The Lafayette bridge company secured the contract to build two new bridges across White river at Ft. Ritner and Riverdale, Ind.

The contract for the Market-st. bridge at Logansport, Ind., was awarded to the Lafayette bridge company, Lafayette, Ind., for $15,999.

Sealed proposals will be received by J. C. Sproule, Winnipeg, Manitoba, until Aug. 15, for the erection of a steel bridge over Osborne-st.

The commissioners of White county, Indiana, awarded the contract for nine iron bridges to the Lafayette bridge company for $2,285.

The contract for a bridge across the Susquehanna river at Allenwood, Pa., was awarded to Smith & Campion, Mahanoy City, Pa., for $36,500.

The contract for the north abutment of the new county line bridge, New Carlisle, Ind., was awarded to W. H. Larner, Goshen, Ind., for $2,900.

The contract for building six iron bridges at Girard, Kas., was awarded to George E. King bridge company, Des Moines, Ia., at $1,758.

The Penn bridge company, Pittsburg, Pa., secured the contract to erect a bridge across the Garcitas river, Victoria, Tex., for $1,599.

The commissioners of Lock Haven, Pa., will build a new bridge in Porter township. Proposals for the masonry will be received until Aug. 20.

The Chicago bridge company was awarded the contract for constructing a bridge across the Brazos river at Hempstead, Tex., for $17,910.

The E. Kunert manufacturing company secured the contract to build the new iron bridge over Rock river at Horicon, Wis., for $1,950.

The contract for building a new bridge across the James river at Columbia, S. D., was awarded to the Milwaukee bridge and iron company.

City Engineer H. J. Stanley, Cincinnati, O., is preparing plans for new bridges to be constructed over Kenton-st., Fern-st. and Mill creek.

The Toledo bridge company was awarded the contract for constructing the bridge connecting St. Augustine, Fla., and Anastasia island.

The Hilton brilge construction company was awarded the contract for constructing the Northern boulevard viaduct, Albany, N. Y., for $56,833.80.

The board of bridge commissioners, Noblesville, Ind., awarded the contract for three new bridges to the Indiana bridge company at a total cost of $2,147.

The contract for constructing a steel bridge across the Monongahela river at Tenth-st., Pittsburg, Pa., has been awarded to Drake, Stratton & Co.

The contract for the construction of seventy feet span bridge over Twelve-Mile creek, Newport, Ky., was awarded to the Bracket bridge company at $990. The Indiana bridge company was awarded the contract for the fifty-six feet span.

Sealed proposals will be received by George Elliott, county clerk, Valentine, Neb., for the construction of two bridges across Niobrara river, until Aug. 6.

Charles R. Kennedy, New Orleans, La., will receive bids until Aug. 9 for constructing a bridge across Bayou St. John, at Dumaine-st.; $250 deposit required.

The Owego bridge company, Owego, N. Y., was awarded the contract for constructing a new bridge across the Hudson river at Luzerne, N. Y., for $14,585.

Bids will be received by R. B. Gordon, jr., Wapakoneta, O., until Aug. 30 for constructing an iron bridge across the Auglaize river; also for two stone abutments.

The township boards of Springwells and Ecorse, Mich., have decided to build a bridge across Rouge river, to cost about $21,000.

The Indiana bridge company, Muncie, Ind., was awarded the contract for constructing a bridge across the Little Androscoggin, at New Auburn, N. Y., for $3,600.

The contractors for the Roaring Brook bridge, Scranton, Pa., are experiencing much difficulty in constructing the central pier, being unable to locate the foundation.

The Gillette & Herzog bridge company, Minneapolis, Minn., who secured the contract for building the Como-ave. bridge, St. Paul, Minn., have refused to carry out the contract.

Sealed bids will be received by the board of county commissioners, Aberdeen, S. D., on Aug. 12, for building two steel bridges, one over Foot creek, and one over Elm river.

The Columbus bridge company was awarded the contract for constructing a truss bridge at Tecumseh, Mich., for $1,360. Lowry & Mitchell secured the contract for stone work for $1,800.

Bids will be received by S. L. Bay, Richmond, Mo., until Aug. 2 for a new bridge near residence of John E. Linville, and until Aug. 3 for a new bridge near residence of A. F. Fowler.

Sealed proposals will be received by the board of county commissioners, Cincinnati, O., for constructing a bridge over Mill creek near Ivorydale until Aug. 10. Bidders must submit designs.

Bids will be received by George C. Zimmerman, clerk county commissioners, Cincinnati, O., for new abutments and wrought iron Pratt truss bridge over west fork of Mill creek until Aug. 3.

Proposals in triplicate will be received until Aug. 12 for a new superstructure and alterations of abutments and piers of bridge across the Mississippi river between Davenport, Ia., and Rock Island, Ill., by A. R. Buffington, coloned of ordinance, Rock Island, Ill. Bond of $5,000 required.

The contract for constructing a bridge to span the Blanchard river, one and one-half miles north of Mt. Blanchard, O., was awarded to the Canton bridge company for $1,950. The Toledo bridge company secured the contract to replace the Gillepsie bridge across the Blanchard river for $3,350.

Leyden & Drew were awarded the contract for building the substructure of the Diversey-st. bridge at $14,526. The Lassig bridge and iron works secured the contract for the superstructure for $14,790.

Phillip Walther, auditor, Lima, O., will receive bids until Aug. 6 for constructing an automatic swing bridge across canal at Spencerville; also for an eighty feet span bridge and abutments across Riley creek, near Bluffton, O. Bidders must furnish plans for abutments.

PARKS.

Rutland, Vt., has a new park.

A park is proposed for Huntington, W. Va.

Cumberland, Ia., will have a new public park.

Orange, N. J., is agitating the question of a new county park.

Oshkosh, Wis., expects to spend $12,000 in park improvements.

Camden, N. J., has acquired two and one-half acres for a public park.

A new park fronting on Connecticut river is proposed at Hartford, Conn.

The board of park commissioners, Duluth, Minn., has issued its annual report.

The park committee is considering the enlarging of Riverview park, Quincy, Ill.

Earnshaw & Punshon, Cincinnati, O., will lay out the new city park at Burlington, Ia.

An ordinance has been passed by Chicago's city council ordering a new park on the lake front.

The park commissioners, Rochester, N. Y., favor the acquisition of more territory at Genessee Valley park.

Pittsburg, Pa., is contemplating purchasing part of the Dupont property as an addition to Schenley park .

The Park commission, Newark, N. J., has petitioned the city for the old reservoir tract for park purposes.

The city of Baltimore, Md., will pay $710,000 for Clifton, a new public park to be located on the Hartford road.

It is proposed to extend Werner park, Rochester, N. Y., a distance of about 600 feet westward from its present terminus.

An ordinance appropriating $52,500 for the purchase of additional park property was reported on favorably at Philadelphia.

The Essex park commission, Newark, N. J., which is to spend $2,500,000 in establishing public parks, has requested the board of works to transfer to the commission the land formerly belonging to the old acqueduct board.

STREET LIGHTING.

McGregor, Ia., has voted for an electric light system.

Hawkinsville, Ga., contemplates building an electric light plant.

Madisonville, Ky., wants bids for furnishing an electric light system and power house.

Dayton, Ky., will receive bids until Aug. 5 for lighting the city with thirty-eight arc lights for five years.

Alex Milne, Ayrmer, Canada, will receive bids until Aug. 5 for lighting the streets by electricity.

H. W. Latimer, city clerk, Canton, Miss., will receive bids until Sept. 2 for an electric light plant.

W. E. Sudlow, Florence, S. C., will receive plans for supplying an electric light system of 500 incandescent and 100 arc lights.

Sealed proposals for electric lighting will be received until Aug. 2 by W. T. Kitchens, El Paso, Tex. Certified check for $2,500 required.

The Log Cabin farm syndicate, Detroit, Mich., will put in an electric light plant soon. Mr. Cameron Carrie, secretary, will furnish information.

MUNICIPAL BONDS.

Altoona, Pa., will issue bonds in the sum of $280,000.

Jamaica, N. Y., will bond itself for $200,000 for improvements.

Bids for $11,000 bonds will be received until Aug. 1 by F. H. Belden, city clerk, Canton, O.

Hamilton, O., will vote Aug. 3 on the question of issuing $65,000 additional waterworks bonds.

M. M. Thompson, auditor, Kenton, O., will receive bids until Aug. 10 for $27,000 6 per cent. bonds.

Bids will be received until Aug. 7 at Toledo, O., for the sale of $7,084.18 5 per cent. improvement bonds.

Bids will be received nutil Aug. 5 by A. O'Leary, city clerk, Anaconda, Mont., for $34,000 6 per cent. bonds.

F. M. Remy, city clerk, Mansfield, O., will receive bids for $15,500 6 per cent. improvement bonds until Aug. 5.

Bids will be received until Aug. 20 by John Laubenthal, mayor, Holgate, O., for $10,000 6 per cent. improvement bonds.

Bids will be received until Aug. 15 by H. L. Rossiter, city auditor, Cleveland, O., for $200,000 4 per cent. water works bonds.

C. H. Baker, West Carrollton, O., will receive bids for the purchase of $6,000 6 per cent. water works bonds until Aug. 16, 1895.

Frank Ellenbecker, county auditor, Little Falls, Minn., will receive bids until Aug. 17 for the purchase of $2,500 5 per cent. bonds.

Sealed bids will be received by James Connors, mayor, St. Ignace, Mich., for the purchase of $7,500 6 per cent. electric light bonds until Aug. 10.

Bids will be received by J. Howard Edwards, city clerk, Youngstown, O., until Aug. 19 for the purchase of $160,000 5 per cent. water works extension bonds.

Sealed bids will be received until Aug. 20 by Samuel J. Wilkerson, city clerk, Springfield, O., for the purchase of $6,159.35 6 per cent. paving bonds.

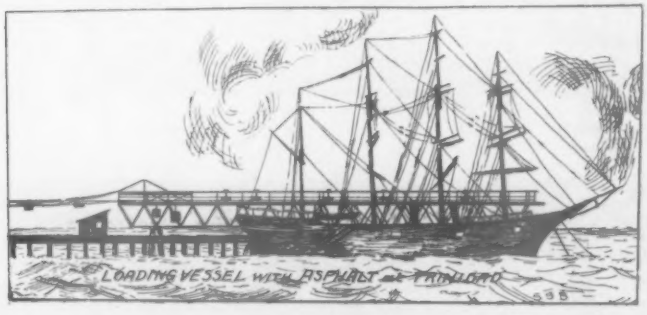
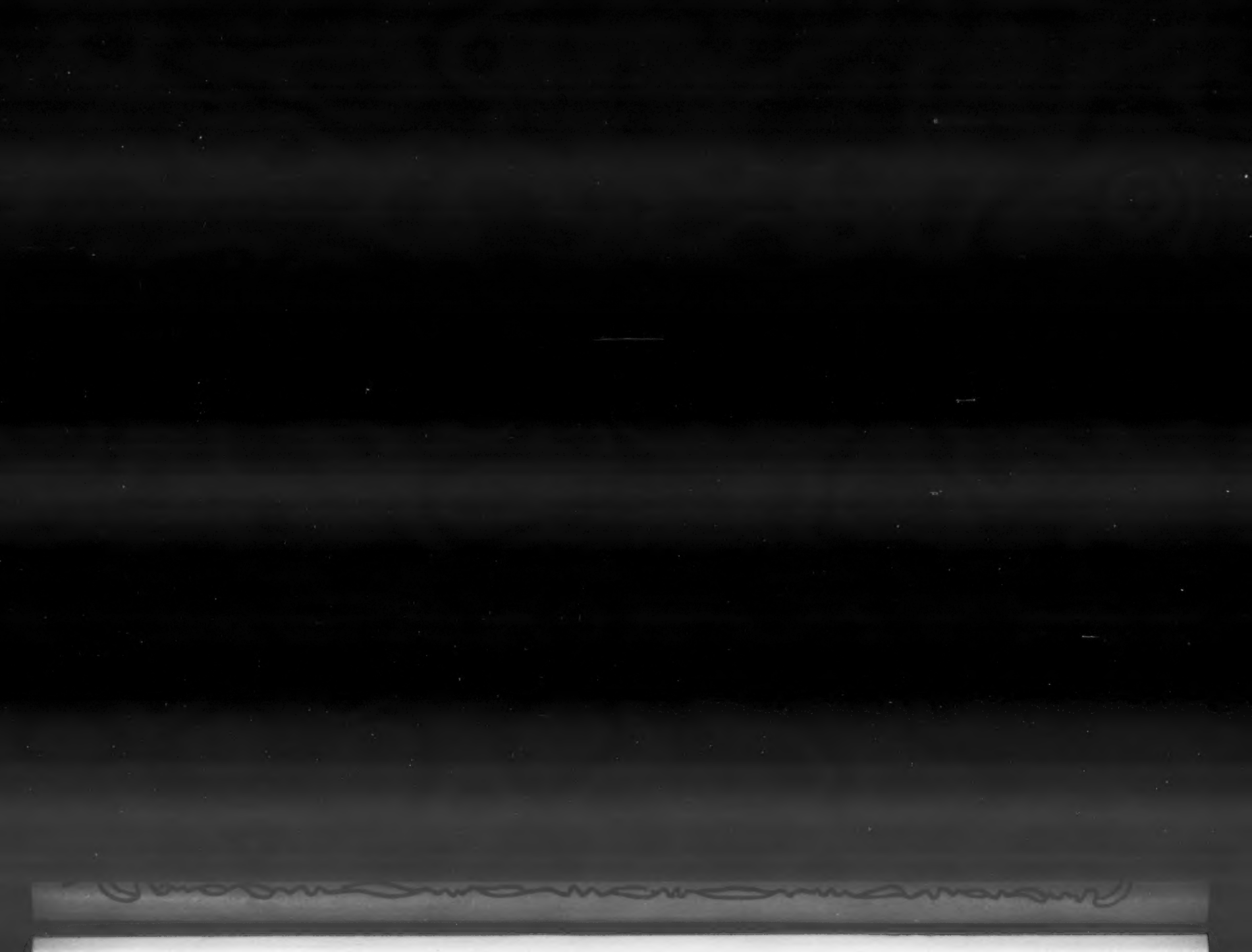
The Trinidad Asphalt Lake

The questions are often asked about this lake : Where is it ? How large ? What does it contain ? What is asphalt ? Is it hard or soft ? How is it obtained ? How refined ? What is it good for ?

This remarkable formation, known to the world as the "Trinidad Asphalt Lake," is situated two-thirds of a mile from the shore and covers an area of about one hundred and fifteen acres. It contains a vast quantity of natural mineral pitch, technically known as asphaltum. Except at the center of the lake, it is hard enough to bear the weight of the people and the wagons which gather it. At the center it is quite soft and would soon engulf a person standing upon it. It is obtained by being loosened with a pick, and thrown into the wagons or tram-cars on its surface. The asphalt is carried on a tram-way to the shore and out to the end of the ocean pier, where it is dumped into the steamers and other vessels which carry it in large quantities to America and Europe.

Crude asphalt is a natural mineral pitch, closely related to the softer bitumen called "Maltha" and "Petroleum," which is a bituminous oil. The dry brittle bitumen, harder than asphalt, is called "glance-pitch." Asphalt is not sticky at any weather temperatures, nor when cool, after having been refined by being heated for two or three days in large complicated retorts.

Asphalt is refined to remove moisture, vegetable and some earthy matter. Refineries are situated at many points on the seaboard of the United States, also at a few places in Europe. Refined Trinidad Lake Asphalt is especially valuable for laying street pavements which are healthful, quiet, safe, luxurious, clean, smooth, durable, economical and popular. Trinidad Lake Asphalt is used, when heated, to form a cementing material which holds together the sand and other parts of this remarkable pavement, which has been a success during the past twenty years, and is laid in more than eighty cities of America, to the extent of 17,206,716 square yards, or the equivalent of 1,117 miles of roadway. It gives employment to about 7,000 persons, either connected with obtaining, shipping and refining it, or with one of the thirty or more paving companies which purchase and use this standard material.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